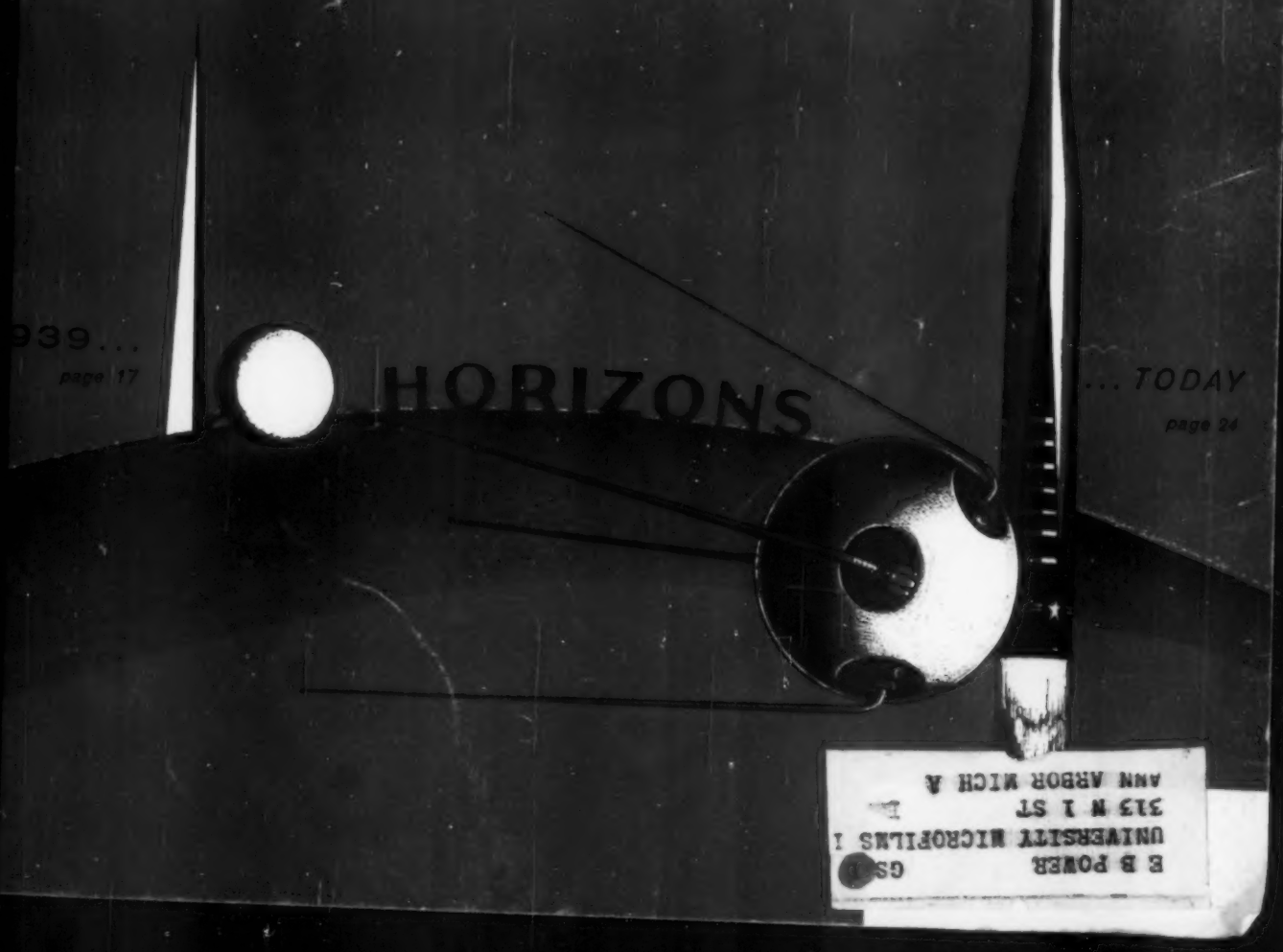
DECEMBER 16, 1957 PRICE 50 CENTS

RESEARCH and DEVELOPMENT edition

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN RESEARCH AND DEVELOPMENT

Why Shackle RESEARCH? page 32

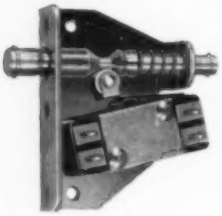


E B POWER GS
UNIVERSITY MICROFILMS I
313 N 1 ST
ANN ARBOR MICH A

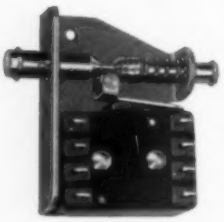
TYPICAL ELECTRO-SNAP INTERLOCKS

Push to operate;
returns automatically.

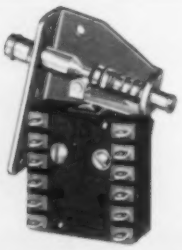
Pull to operate;
remains in operating position until reset for automatic return by next full-stroke push operation.



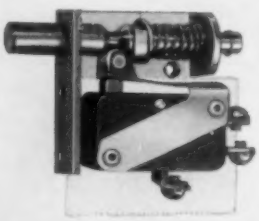
MODEL C2-4 S.P.D.T. 2 ckts. **Elec. rating:** 125/250 V.A.C., 30 V.D.C. —10 amps. 125 V.D.C., ½ amp. 250 V.D.C., ¼ amp. **Oper. force:** 2 lbs. ± 12 oz. **Weight:** 2 oz. **Dimensions:** 1-13/16" x 1-31/32" x 9/16"



MODEL C2-9 D.P.D.T. **Elec. rating:** 15 amp. 125/250 V.A.C. 60 cycle. **Oper. force:** 4¾ lbs. ± 12 oz. **Amb. temp:** —100° to + 275° F. **Elec. & Mech. Life:** 150,000 ops. **Weight:** 2 oz. approx. **Dimensions:** 1-29/32" x 1-31/32" x 9/16"

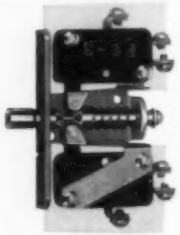


MODEL C2-14 T.P.D.T., 6 ckt. **Pre-travel:** 5/32" min. **Overtravel:** ¼" approx. **Mov. Diff.** .028" ± .007" **Elec. rating:** 15 amp. 125/250 V.-A.C.—15 amp. 30 V.D.C., res.—10 amp. 30 V.D.C., ind. **Life**—500,000 ops. min. **Dimensions:** 2-5/16" x 1-31/32" x 9/16"



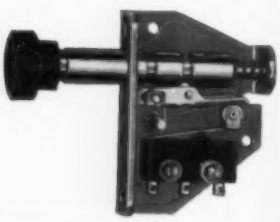
MODEL C2-5 Solid shaft. S.P.D.T. **Elec. rating:** 10 amps. @ 125/250 V.A.C., 60 cycles. **Oper. force:** 2 lbs. ± 12 oz. **Amb. temp.:** —100° to + 275° F. **Elec. & Mech. life:** 150,000 ops. **Weight:** 2 oz. **Dimensions:** 1-13/16" x 1⅞" x ½"

MODEL C2-10 same as C2-5, except has threaded shaft.

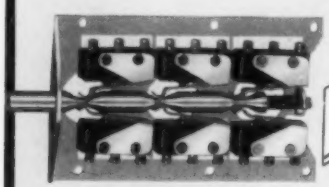


MODEL C2-7 Solid shaft. D.P.D.T. **Pre-travel:** 3/16" max. **Elec. rating:** 10 amp. 125/250 V.A.C. 60 cycle. **Amb. temp.:** —100° to + 275° F. **Elec. & Mech. Life:** 150,000 ops. **Dimensions:** 2-3/32" x 1⅞" x 33/64"

MODEL C2-6 same as C2-7, except has threaded shaft.



MODEL C2-15—Subminiature interlock. S.P.D.T.; **Elec. & Mech. Life** and **Rating:** 150,000 ops. @ 2.5 Amps., 125/250 V.A.C.; 100,000 ops. @ 5 amps, 125/250 V.A.C. **Dimensions:** 1-13/16" x 1¼" x 9/16". Various colored buttons available.
(Also available in momentary contact, one-way impulse action.)



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how to cut control costs

with no sacrifice in switch reliability!

These proved-in-use interlock switches are now standard production items at ELECTRO-SNAP

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—our only business!

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

Research AND Development EDITION

December 16, 1957 Vol. 28, No. 24

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● **Russian scientific achievements** are impressive and well publicized (see p. 24). But, as always, anything hitting the headlines becomes the target for political commentary. The latest, from Yugoslavia, insists that Sputnik *had* to be Russian. It was pushed into orbit with great force, followed a prearranged line, had to report every 2 min, and all it could say was beep-beep.

● **Our editor's November expense account** includes an item of $1.25 "for pressing Santa Claus suit." This should raise howls in Accounting. Our portliest staff member wore the suit when posing (with 22 model toys) for the picture on next week's Design edition cover. There were 15 lights in the setup and Santa Claus lost five pounds—mostly to the suit, which came out wringing wet. No acceptable expense-account item could be dreamed up to cover the lost five pounds, but there was a citation for services "above and beyond the call of editorial duty."

● **Basic research** is half accident, half blind groping (p. 30). We remember the experience of a manufacturer when ball-burnishing a small batch of rivets. Unfortunately the steel balls which were tumbled with the rivets were almost exactly the same size as the hole in the end of the rivet. A third of the rivets came out with a ball neatly jammed into the hole. In the true spirit of scientific inquiry, the plant superintendent remarked, "Well, if we ever want to put balls in the ends of rivets, we'll know how."

● **Our investigations** into the New York World's Fair (p. 17) led inevitably to the newspapers of the day. The yellowed (1939) pages sing a familiar refrain—Mary Martin was at the Rainbow Room, there was a Dorsey orchestra at the New Yorker, and theater and movie critics pleaded for more true-to-life themes, more meaningful political and social commentary. What was different? You could buy a new Pontiac for $758; a Hudson for $695.

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ALLENPOINT will give you a bulldog grip at no premium in price!

Allen's scientific redesign of the cup diameter on set screws gives greatly increased resistance to *withdrawal* torque. You can count on Allenpoint Set Screws to stay tighter longer, under heavy strain and vibrations. This dependable premium performance of Allenpoints is yours to use without increasing the cost of manufacturing your products.

Uniform Class 3A Threads

Allenpoints' smooth, uniform threads prevent off-lead conditions like Fig. 1. With Allenpoints, you have full, even contact between the engaging flanks of the threaded members (Fig. 2) —and a tight friction lock over the entire length of the Allenpoint Set Screw.

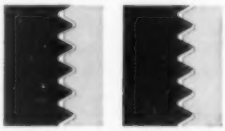
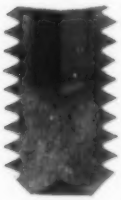


Fig. 1 Fig. 2

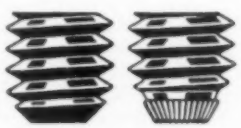
Strong, clean, deep sockets allow full wrenching leverage



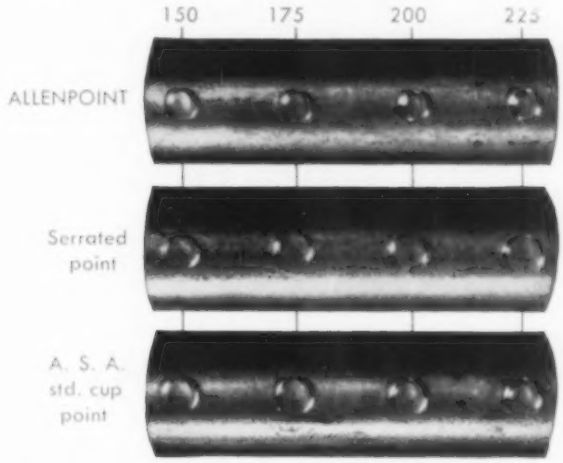
Sockets of Allenpoint Set Screws are cold forged to produce a deeper, smoother socket. No broach chips to interfere with proper seating of the key. This "pressur-forming" preserves the long steel fibers throughout the length of the screw—stronger walls allow maximum tightening torque.

One more full thread on ALLENPOINTS!

Allenpoint Set Screws have one more full thread than serrated point set screws. That means more holding power—especially important when you're using short lengths.



ALLENPOINT's performance compared for you



These actual-size, unretouched photographs show the cup pattern made by Allenpoints, serrated points, and A.S.A. standard cup point set screws in a 3/4" steel shaft. At each degree of tightening force, Allenpoints make a full circle pattern, penetrating deeper for greater holding power.

We'll be glad to send you more information and samples of Allenpoint Set Screws and other Allen Socket Screw products.

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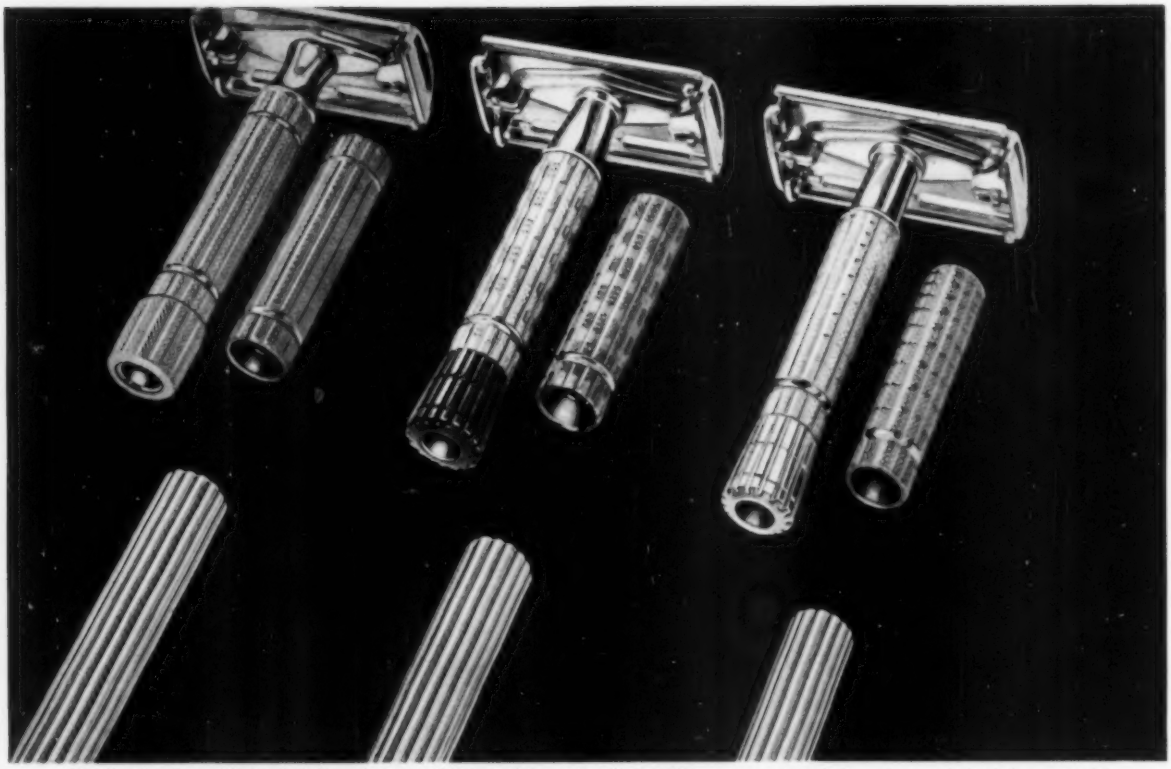
ALLEN HEAD HEX-SOCKET SCREWS



Handles for the gold-plated (left) and standard "Heavy" (center) Gillette safety razors are made from Anaconda leaded commercial bronze special-shape seamless tube, .4525" O.D., .371" I.D. "Regular" model (right) is of commercial bronze .395" O.D., .324" I.D.

Gillette shaves costs with Anaconda special-shape tubes

The problem: The Gillette Safety Razor Company, Boston, Mass., formerly used drawn shells for the handles of its famous line of razors. Press-fit assembly of components called for very close tolerances and suppliers of the drawn shell had difficulty in controlling the dimensions to the accuracy required. Rejects and production delays were becoming a costly problem to Gillette, and there was also excessive waste of material in trimming the shells after the knurling, grooving and rolling operations.

The solution: American Brass Company representatives suggested the use of special-shape (fluted) tubes to meet the tolerances required—in alloys suitable for the machining operations. Gillette tried the idea and now uses Anaconda special-shape tubes for handles of three models.

Long lengths of the tube are fed into high-speed, multiple-spindle machines which automatically convert the tube to razor handles ready for the plating room. Production is greatly increased, rejects and waste material are reduced to a minimum, and the uniformity of the handles simplifies assembly. Most important of all to the Gillette Safety Razor Company is the improved quality of the finished product.

Save Material and Production Costs: Special-shape seamless tubes—of copper, copper alloys or aluminum—in standard lengths, or cut to specified lengths, can save several steps in arriving at a finished product. The American Brass Company's French Small Tube Division are specialists in producing small tubes (up to ¾" O.D.) of special design and, in addition to maintaining a wide range of stock dies, are ready to cooperate fully in the development of new shapes to meet specific requirements.

For Action: Contact our nearest District Sales Office or send a sample, drawing or description, estimated quantity, kind of metal required and other pertinent data to: The American Brass Company, French Small Tube Division, Waterbury 20, Conn.

5772

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SPECIAL-SHAPE TUBES IN LONG LENGTHS OR CUT UP—
IN COPPER, BRASS, BRONZE, NICKEL SILVER, ALUMINUM

DEVELOPMENTS TO WATCH...

286 million major appliances . . .

. . . will be shipped to market in the next 10 years, Hotpoint Co. predicts in its latest annual forecast. But the sales curve won't be moving up for every type. Hotpoint expects free-standing ranges to decline as popularity of built-in units grows. Shipments of water heaters are also expected to decline; while there'll be a big boom in dishwashers, disposers, and combination washer-dryers. The chart tells the story.

Major appliances	Units shipped from factory 1957	1967
Cabinet ranges	920,000	900,000
Custom ovens	420,000	1,600,000
Refrigerators	3,320,000	5,100,000
Freezers	890,000	1,110,000
Air conditioners	1,750,000	3,700,000
Water heaters	790,000	760,000
Dishwashers	360,000	1,140,000
Disposers	500,000	1,200,000
Comb. washer-dryers	165,000	1,900,000

For instrument dials, emergency lights . . .

. . . watch faces, and other lighting and indicating jobs, there's a new luminous paint that promises to last 10 times longer than radium paints, and be a lot softer. It's based on the man-made isotope, tritium (Hydrogen 3), can be made in a variety of colors and is expected to be competitive with radium in price. It's now awaiting AEC certification, should be on the market within a few months. (The company which developed this product has requested that its name not be revealed until the AEC permit is issued. Requests for information will, however, be forwarded for answering at that time.)

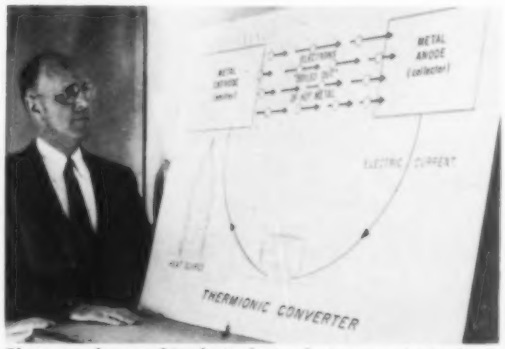
Lower-cost high-temperature ceramics . . .

. . . are promised by new techniques being developed at Georgia Institute of Technology's Engineering Experiment Station. According to Tech's ceramic-research group, bonded fused silica ceramics for rocket nose cones and refractory linings can undercut the price of rival materials now on the market. They've produced materials resistant to continuous thermal shock that will stand temperatures above 2000 F, and some that will stand 3000 F if extreme thermal conditions are absent. Short-term life is in the 4500 to 5000-F range, they report. Secret of Tech's success is close control of the milling process to control size of the silica particles, and a new bonding method that does not involve using clay. Next step: techniques to permit pressing, rather than casting, the fused silica to shape.

Direct conversion of heat into electricity . . .

. . . with an efficiency of 30% or more. That's the hope, and prediction, of researchers at General Electric now exploring possibilities of "thermionic" conversion. "Already," says GE's Dr. Volney C. Wilson, "experimental converters have changed more than 8% of the applied heat energy directly into electric power."

A good many laboratories are today working on this conversion problem, and exploring possibilities of semiconductors and new electronic devices as well as the older thermocouple techniques (No. 25, p. 9). They agree that commercial application of heat conversion in such devices as the proposed "electronic refrigerator" is well in the future. But all this interest in the problem shows it's important —and promising—one.



Electrons from white-hot electrode traverse ionized gas to collect on "cold" electrode and travel on into an electrical circuit, as shown in this schematic GE diagram.

American...

(continued)

DEVELOPMENTS TO WATCH...

Next year's "wonder metal"...

. . . may be rhenium. It's scheduled for intensive research and promotion, and looks like a "comer" for electrical, electronic, and atomic use. There are still hurdles to jump. But Chase Brass & Copper is now ready, while going on with development, to deliver it on a "commercial" though limited basis. Chase expects to produce about 10 lb a month next year, at prices ranging from $680 per lb for the high-purity powder to $1150 per lb for ductile 0.010-in. strip. That's not cheap and it doesn't sound like quantity production; but a variety of forms will be available, and the production rate is far above anything previously attained.

Rhenium is attractive for several reasons. This heavy, silver-white metal, somewhat resembling platinum in appearance, is chemically similar to manganese. It has good corrosion resistance, particularly to hydrochloric acid, and a very high melting point. It resists oxidation, even in powdered form, to at least 700 F. Above 1100 F, though, it oxidizes rapidly.

Battelle Memorial Institute, which has studied it extensively, says rhenium can attain a tensile strength of about 350,000 psi. As J. H. Port, assistant chief physical metallurgist at Chase, points out, it is ductile in the annealed condition, but "its rate of work-hardening is greater than for any other metal."

Rhenium alloys readily with elements of the platinum group and, says the Bureau of Mines, thermocouples made of platinum-rhenium and platinum, and similar iridium and rhodium combinations, can be used at temperatures to 3450 F.

Where can rhenium be used? In thermocouples and other electrical contacts, possibly also as a radio-tube and lamp-bulb filament (it's said to be more resistant to volatilization than tungsten), spark plug points, and nonconsumable electrode tips for melting and welding. Rhenium plate can be used to protect silver and other tarnishable alloys. —ARG

Stored energy in an efficient form . . .

. . . to drive turbines, pressurize hydraulic systems, operate pneumatic servos, and perform many other functions, can be obtained from solid and liquid propellants used in the form of baby rockets and gas generators (Oct. 14, p. 9). Sperry Corp. is experimenting with them for gyroscope operation; reports that a doughnut of solid propellant less than ½ in. dia. (see photo) will accelerate a gyro to a speed of 50,000 rpm in 0.2 sec or less. Detailed information on propellants and explosives as a power source, and suggested uses will appear in the Jan. 6 issue.

Tiny solid-propellant cylinder can give gyroscope the start it needs. Note how propellant fits in rotor.

READER TO EDITOR

Don't Judge by Photos

To the Editor:

Your comments in "Sidelights" (Nov. 18, p. 2) referring to a pyramidal form of headstock, which has found wide acceptance in the automotive and allied industries, arouses a suspicion that your judgment was engendered by looking at photographs and not from seeing the machine under actual working conditions. When in use, there are usually work trays standing at either side of the operator that would effectively prevent anyone from walking too close to the machine.

This design was developed abroad and was in use for a number of years in European manufacturing plants before it was offered in Detroit. —William B. Retz

Director, Development Engineering
New Britain Gridley Machine Div.
New Britain, Conn.

Mousetrap Snaps When Phone Rings

To the Editor:

Apropos of your column, "Why Don't They Research and Develop," in which you request an indicator which will show when an unattended telephone had rung during one's absence, (Oct. 21, p. 54) perhaps you would be interested in how I solved this problem. I replaced the spring on a mousetrap with a lighter one, set the phone on a corner of the set trap. The vibration of the ringing bell, transmitted through the case to the trap, was sufficient to trip the spring.

Once, when I had a noisy operation under way and couldn't hear the bell, I attached a mercury switch to the trap and had it flash on a large light to attract my attention.

—John Kurmer
Philadelphia, Penna.

Wants More Plays

To the Editor:

Your 3-act play (Nov. 18, p. 36) is an excellentidea. Let's have more.

George L. Freese
NorthGranby, Conn.

PUTTING THE DIFFERENCE IN DIFFERENTIALS WITH

CYPAK

to speed production and cut rejects at Canadian Acme Screw & Gear, Ltd.

CYPAK* static controls do the thinking on Canadian Acme Screw & Gear's new 15-station transfer machine, producer of differential cases for automobiles . . . choose each operation in the sequence . . . signal the component stations to perform at the correct instant . . . provide maximum continuous operation with less down time, fewer rejects.

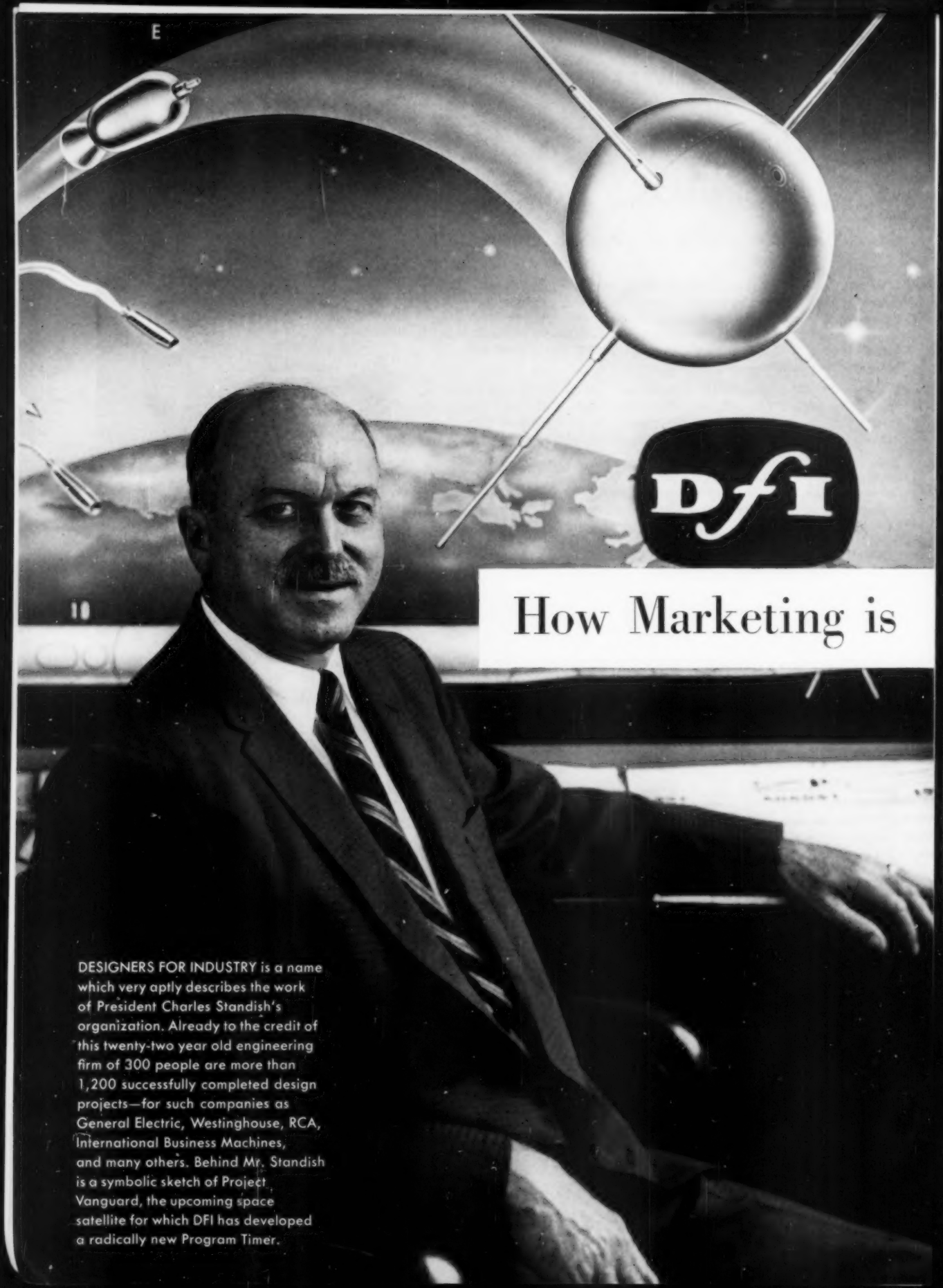
Because Cypak is completely automatic . . . has no moving parts to wear or jam, it can perform the most complicated functions faster, with no mistakes. And you can count on Cypak to give you 15 times longer operating life than conventional relay controls.

Ask your Westinghouse sales engineer for detailed information about the ways Cypak can benefit you. Or write Westinghouse Electric Corporation, Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania. J-22076

*Trade-Mark

YOU CAN BE SURE... IF IT'S

Westinghouse



DESIGNERS FOR INDUSTRY is a name which very aptly describes the work of President Charles Standish's organization. Already to the credit of this twenty-two year old engineering firm of 300 people are more than 1,200 successfully completed design projects—for such companies as General Electric, Westinghouse, RCA, International Business Machines, and many others. Behind Mr. Standish is a symbolic sketch of Project Vanguard, the upcoming space satellite for which DFI has developed a radically new Program Timer.

"Companies come to us when they think our wide experience can provide original solutions to product design and development problems. In turn, we go to manufacturers' catalogs for the specific help we need in selecting the best materials and components to incorporate in our design recommendations to DFI clients.

"It is important, however, for manufacturers to realize how big and bothersome a problem the securing, filing, and maintenance of catalogs can be—and how much they do to eliminate this problem when they pre-file their catalogs in Sweet's. It is encouraging to note the increasing number of manufacturers who, by making their catalogs available to us in these convenient, instantly accessible collections, are making it easier for us to find out what we need to know about their products."

Charles J. Standish, *President*
Designers for Industry, Inc.
Cleveland, Ohio

solving a major Engineering problem

Industry's engineers continually confirm the fact that pre-filed catalogs make it *as easy as possible* for them to find out what they want to know about products they need. As a result, they use these catalogs more often than any other source of specifying and buying information.

In a recent survey among more than 2,000 design and plant engineers, for example, 93% had referred to catalogs pre-filed in their Sweet's Files—and 97% of these users reported that such reference had helped them find wanted products.

Instantly accessible, convenient, time-saving, up-to-date—pre-filed catalogs are their own best answer to the rising tide of demand, among engineers everywhere, for the continuing growth of this practical solution to the "catalog problem."

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This is the first of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

What is an Alloy Steel?

Here is an easy definition to remember: An alloy steel is a grade of steel in which one or more alloying elements have been blended to give it special properties that cannot be obtained in carbon steel.

Or, here is the metallurgical definition: An alloy steel is one in which the maximum specified content of alloying elements exceeds one or more of the following limits—

Manganese, 1.65 pct; Silicon, 0.60 pct; Copper 0.60 pct

or in which a definite range or a definite minimum quantity of any of the following elements is specified or required within the limits of the recognized commercial field of alloy steels: aluminum, boron, chromium up to 3.99 pct, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, or any other element added to obtain a desired alloying effect.

As a rule, alloy steel is more difficult to make than carbon steel. There are more elements to be kept within specified ranges and, in general, the ranges of the alloying elements are comparatively narrow; hence the mathematical chances for producing off-heats are correspondingly increased. Moreover, most alloy steels require special reheating and cooling to prevent such imperfections as flaking and cracking.

Surface imperfections must be removed from the billets by scarfing, chipping, or grinding. More exacting methods of testing and inspection are necessary to insure uniformity.

WHERE DOES IT PAY TO USE ALLOY STEEL?

Generally speaking, it is advisable to use alloy steel when more strength, ductility, and toughness are required than can be obtained in carbon steel in the section under consideration. Alloy grades should also be used where specific properties such as corrosion-resistance, heat-resistance, and special low-temperature impact values are needed.

In some cases it requires considerable study to determine when and how to use a particular alloy steel to advantage in a product. Where there is any problem or doubt concerning its use, Bethlehem metallurgists will gladly give impartial advice on analysis, heat-treatment, machinability, and expected results.

In addition to manufacturing all AISI standard alloy steels, this company produces other than standard analysis steels and the full range of carbon grades.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

American ...Washington

DEVELOPMENTS TO WATCH...

Translation of Russian technical journals . . .

. . . and, more important, making the information available, is slated for Washington attention. This subject will be aired by Congress early next year in hearings to be held by the House Government Information Subcommittee headed by Rep. John E. Moss (D., Calif.). The legislators will first find out how scientists want to receive Russian technical information, then concentrate on setting up a system to provide it.

Right now, government agencies, excluding military and intelligence, spend less than $1 million a year on the program. And, there is no central clearing house that industry can turn to for obtaining the material once it is translated into English.

However, there is some behind-the-scenes maneuvering going on now to set up a clearing house operation. One plan would have the Commerce Department's Office of Technical Services coordinate all technical translations and the National Science Foundation all scientific translations. Estimates are that it would take an additional $1 million or so to put this plan into operation.

Ironically, the Secretary of Commerce was directed by Congress in 1950 to provide such a service, which was to include translations. Budgetary reasons are given as why this was never done broadly.

Transportation costs will go up . . .

. . . early next year, if the railroads get approval from the Interstate Commerce Commission for a new round of rate increases estimated to cost shippers an additional $200-million a year. Traditionally, truckers and waterways follow the rails in boosting rates too.

In spite of the nearly $1-billion a year in rate increases allowed by the ICC to rails early this year, the new request—at least in part—is expected to be approved. Higher operating and labor costs are reasons the railroads are giving for needing the higher rates.

The new rates—when requested—won't come in across the board percentage increases, however. It will be in the form of commodity and class rate hikes. At the time of the hearing the Interstate Commerce Commission will announce the time and place where shippers can oppose the boosts.

How to keep tabs on your technical information . . .

. . . will be explained in a National Science Foundation survey report due out next month. The Foundation surveyed 25 leading companies to see how they handle the matter. There is no evaluation of the various systems used by the companies, but the report will include: a full description of the system; size of the information file; rate of growth of the information; and the number of personnel needed to operate it. Some of the systems used are the IBM 101, Peek-a-Boo, Unitern, etc.

Such companies as DuPont, Monsanto, and Union Carbide were included in the survey.

Less control on defense spending . . .

. . . seems sure to be one result of Eisenhower's illness. That's the thinking in Washington on the president's latest disability. Full impact will not be known for some time, and of course it depends on the speed of his recovery. Initially, the president has made a show of not suffering any ill effects. But, the key thing to watch is how much the doctors force him to curtail activities.

With Eisenhower in the background—even for a brief period—it will give more say in the interim spending decisions to Vice-President Nixon. And, Nixon is decidedly less budget conscious than the president. He's backed up, too, by Secretary of Defense McElroy who favors pumping more dollars into the defense effort. The combination appears to mean looser reins on military spending.

However, any easing up on defense spending is generally viewed to mean a tightening up on non-defense programs. Having already mapped out what areas can stand budget cutting, Pres. Eisenhower will have to exert strong leadership over Congress in January to get his program across. And, if his doctors say it's too much activity, the bulk of the responsibility may fall to Nixon.

World-wide...

DEVELOPMENTS TO WATCH...

A hard, bright tin finish . . .

. . . that's smooth, but not brittle, can be obtained simply by adding a little wood tar to the plating bath, the British Tin Research Institute reports. The finish makes it easy to remove fingermarks and other blemishes, and provides a good surface for soldering. Application studies are still under way, but the Institute says work to date shows the process is practical. For the plating solution, about 8 parts (by weight) of wood tar are used for each 100 parts of stannous sulfate, and a small amount of octyl alcohol is added to help disperse the tar. (Complete formula on request.)

Aluminum parts that stand 930 F . . .

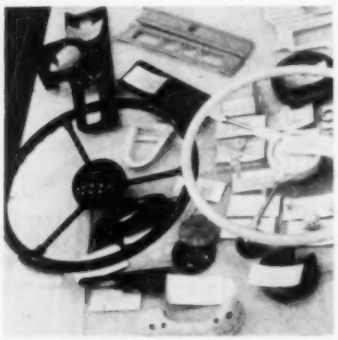
. . . for long periods without losing strength can be produced by new S.A.P. (sintered aluminum powder) techniques, German researchers say. They're turning out parts that have a room-temperature strength "approximately equal to that of heat-treated Al-Cu-Mg alloys"; and because the powdered metal can not recrystallize, "it loses none of its strength at higher temperatures." Parts can be machined and finished like ordinary aluminum, but welding requires special precautions (melting would destroy the structure responsible for the material's properties). Either an abutment welding system, which forces out the melted metal, or a "cold-welding" technique should be used for best results.

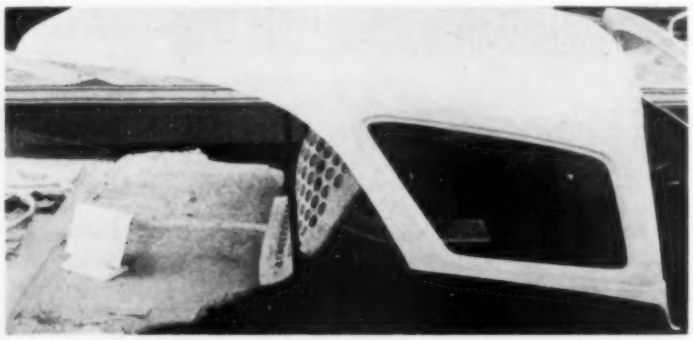
New kind of sprayer . . .

. . . for paints and other materials, designed by N. V. Metaalindustries of Amsterdam, Holland, uses hydrocarbon vapor in place of air, has no moving parts, is said to operate noiselessly and without wear. An electrical heater vaporizes the hydrocarbon (not identified), and an electrically heated rubber pipe conveys it to the atomizer. A separate pipe carries the material being sprayed. Advantage of the hydrocarbon lies in its weight (2½ times as heavy as air, it is said to convey more kinetic energy per unit of volume, increasing the capacity of the sprayer) and in that it will not absorb thinning agents.

Russian auto engineers use plastics . . .

. . . for many of the same things we do; and they too are experimenting with plastic tops. But if the grouping at left (part of a recent Moscow exhibit) is any indication, far fewer plastic parts are used. This does not, however, seem to be a reflection of inadequate molding techniques. Though steering wheels are simple in design, other parts would require close control of material flow and good die design (note unit, upper left, and knobs in center). There is a surprising amount of styling in the form of grids and fins too. (For more information on Russian cars see Nov. 11, p. 111 and Dec. 9, p. 9).





Typical of plastic parts now used in Russian cars are at left. **At right is experimental, plastic, Moskvich car top.**

News about HYPALON®

Gaskets of HYPALON unaffected by 2% ozone after two years' use

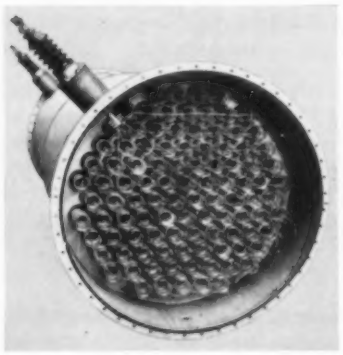
For two years, a large chemical firm has used gaskets of HYPALON in its ozone generators. Despite constant exposure to 2% ozone, not one gasket failed because of ozone cracking.

The ozonator is a steel shell packed with glass tubes. As dry oxygen passes through the tubes, it is converted to ozone by high-voltage electrical discharge. Each end of the shell is closed by a dished head sealed with a gasket of HYPALON.

Plastic gaskets too rigid

Plastic gaskets, which were formerly used in the generators, were unaffected by ozone, but took a permanent set under flange pressure. When a head was removed for routine maintenance the plastic gasket was too distorted to put back. Gaskets of HYPALON are reused.

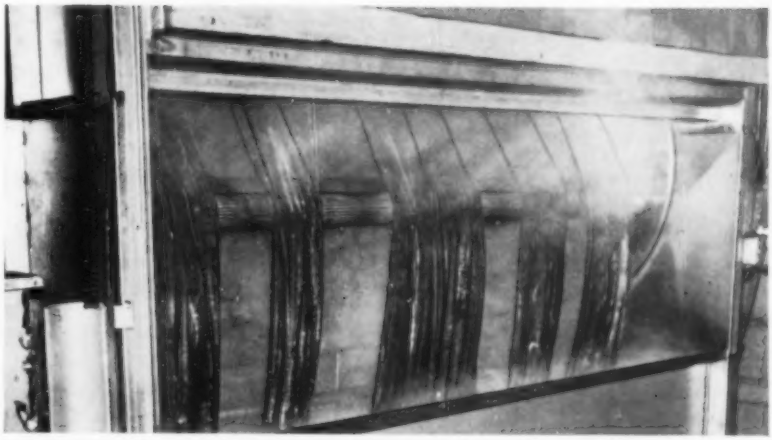
HYPALON offers many additional advantages compared to other types of rubber. It resists strong oxidizing acids; can operate at temperatures from 250° F. to 350° F.; resists weather and sunlight. This Du Pont synthetic rubber can also be compounded in an unlimited range of stable colors. HYPALON offers extra long life and lower operating costs in jobs where conditions are severe. Mail coupon for full information.



Gaskets made of HYPALON seal each end of this ozonator; they show no deterioration after two years in service.

HYPALON *is a registered trademark of E. I. du Pont de Nemours & Co. (Inc.)*

"Non-skid" neoprene reels help dye slippery synthetic fabrics



Fluted neoprene bars show little wear after four years in dye machine. Dye bath may be acid or alkaline, oxidizing or reducing. Temperature is 200° F.

Mill uses neoprene to get needed traction for hauling fabric through dye bath

Chatham Manufacturing Co., of Elkin, N. C., used neoprene to solve an unusual problem in dyeing synthetic fibers. Long loops of the fabrics are dyed in stainless steel piece dyeing machines. Loops, often 100' long, are pulled through the dye bath by means of a reel. The slow rotation of the reel assures even dyeing over the full length of the goods.

The progress of the fabric depends entirely on friction between reel and loop. When several types of metal reels failed to produce enough friction to pull the smooth synthetic fabrics through the bath, Chatham designed special fluted neoprene bars for the reels. They provided adequate traction and ended the problem of slippage and uneven dyeing.

Chemical resistance important

Bars covered with natural rubber could have solved the traction problem but neoprene was chosen for its excellent chemical resistance. In dyeing various fabrics the dye bath may be acid or alkaline, oxidizing or reducing. Each dyeing cycle requires 3-5 hours at 200° F., and the dye machines operate 24 hours a day. Ordinary rubber just couldn't stand this treatment. Chatham's Superintendent of Dyeing, Mr. V. Caton, reports that neoprene has given excellent service for four years with little wear.

Neoprene's resistance to chemicals, heat and abrasion means long-term wear—and economy in many types of service. Mail coupon below for full details on how neoprene can work for you.

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What's happening in SCIENCE

What makes plastics crack and craze?

Why do some plastics develop a spider web of lines that destroy their clarity—and usefulness?

What influences the sizes of these lines, and how deep do they go?

Can heating restore the materials to their original condition?

A research program at the National Bureau of Standards is uncovering useful facts:

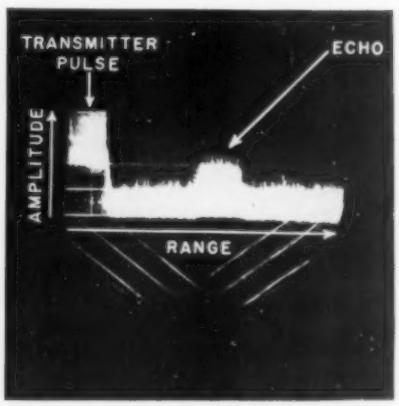
- Primary causes of this defect are stress and the action of solvents. But even the adhesive on masking tape used to protect the surface finish may start the crazing under certain conditions. NBS found flow lines radiating from each droplet of adhesive after previously masked specimens were exposed to high stress, also found that cracks were wider and more frequent where the tape had been used.
- Crazing takes different forms in different plastics. In acrylics it seems purely a surface phenomenon; in polystyrene, both surface and internal cracks are observed.
- Interference microscope studies show each surface crack is surrounded by a raised area that appears to increase with size of the crack.
- These raised areas or peaks can serve as an index of the effectiveness of treating plastics to eliminate crazing defects; they show that, while heating restores clarity, it does not eliminate the mass of dislocated material around the cracks, and thus can not be said to "restore the material to its pristine state."

NBS is continuing the study, aiming now at determining the minimum crack size of different plastics under varying conditions; and, eventually, at finding a treatment to prevent crazing or provide complete restoration.

Radiation makes them bounce

New rubber-like materials are being produced by irradiation of polyvinyl methylether at Naval Research Laboratory. These are materials, which, NRL says, could not be produced by ordinary chemical or vulcanization means. But electron beams (from a Van deGraff accelerator) and gamma radiation (from a cobalt-60 source) do the trick.

While the elastomers are not strong in their original form, adding fillers gives materials that "exceed silicone and polysulfide rubbers in strength," yet show an elongation at breaking of 100% to 200%.



Giant among Sputnik-trackers is this high-powered, long-range radar unit built by MIT's Lincoln Laboratory. Reflector is 84 ft dia; tower, 90 ft high. Even the klystron tubes are king-sized. They're 11 ft long. As photodiagram at right indicates, tracking is done by putting the Doppler (echo) effect to work (see Nov 18, p. 15).

atom briefs . . .

Are nuclear merchant ships economically practical? Only in situations justifying "a large premium for extreme endurance and high sustained speed," says Dr. Walter H. Zinn, president of General Nuclear Engineering Corp. and consultant to the AEC. Even taking an optimistic view, Dr. Zinn points out that the nuclear part of a steamship propulsion plant would likely cost at least $450 per shp or $600 per shaft kw.

Obsolescence of fission reactors isn't a problem yet—the AEC says creating a controlled thermonuclear reaction to produce power will require a temperature of at least 100 million C.

At highest accelerations and temperatures (5 or 10 million C) thus far reached in the laboratory, neutrons have been observed, but it is difficult even to tell whether they are thermonuclear products. Says British nuclear pioneer Sir John Cockcroft: Mission reactors will probably have a long and useful life before large-scale fusion plants are in operation.

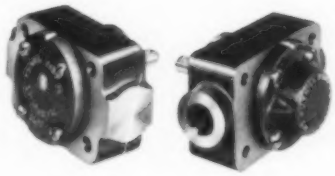
Atom grease: A new lubricant developed by Shell Oil Co. for nuclear reactor use, is said to have "excellent thermal stability and lubricity at 300 F," plus ability to stand an accumulated dosage of 1×10^9 roentgens. Shell is calling it "APL Grease," will make it available commercially.

Strongest cobalt 60 source thus far produced is a 12-gm sample irradiated by Phillips Petroleum Company's Atomic Energy Div. at the AEC's Idaho reactor station. It's a cylinder that weighs less than 12 gm, but has a specific activity of 226 curies per gm —more than twice that of any sample previously produced. Irradiation took nearly four years.

Biggest cobalt source to move in a single shipment was 15,000-curie assembly of cobalt pellets bound for Esso Research & Engineering Company's laboratory at Linden, N. J. While specific activity of these pellets is not as high as the source mentioned above, the size of the source more than makes up the difference.—ARG

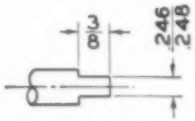
NOW! Have Reliable Lubrication at Minimum Cost

Models LF and RF
Capacities 55-170 g.p.h. at 1800 r.p.m.
Designed for flange mounting without shaft seal; with *choice* of internal or external porting. Model RF has automatic reversing feature which permits driving the pump in either direction... without changing direction of flow or port positions.

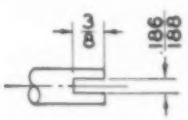


Models LFD and RFD
Capacities 60-180 g.p.h. at 1800 r.p.m.
Designed for non-directional service; for flange mounting with internal porting. Variations for external porting and/or shaft seal are shown below. Model RFD has the automatic reversing feature which permits driving the pump in either direction... without changing direction of flow or port positions.

ALTERNATE SHAFT DRIVE ENDS
For All Models



MODIFICATION "A"



MODIFICATION "B"

Tuthill "Cartridge-Type" Pumps Solve This Problem for Plant Maintenance...and Original Equipment Manufacturing

Durable—Reliable—and Available from Stock!

1. The demand for minimum cost lubrication pumps without sacrifice in performance, durability and reliability is *ideally* satisfied by the TUTHILL series of Models LF, RF, LFD and RFD *cartridge-type* pumps.

2. TUTHILL "cartridge" pumps get their reputation as cost-savers from their special design for original equipment use, their durable construction, their reliability...and the fact that they are *available from stock*. Note their compact size as shown in the photos above. Consider how all waste space has been eliminated for more adaptability. Think how they can be easily applied to your *own* requirements...in your plant...or in your equipment manufacturing plans.

3. These variables are available:

a. Pumps with...*or without*...automatic reversing performance

b. Pumps with...*or without*...a shaft seal

c. Pumps with internal...*or external*...porting

d. Pumps with *variations* of both internal and external porting

4. TUTHILL Catalog Section 108 contains line drawings showing each model in detail, shaft rotation and porting arrangements and other vital statistics to help you select the RIGHT model. Fill out the attached coupon—or write.

TUTHILL PUMP COMPANY
963 E. 95th Street, Chicago 19, Illinois

Gentlemen:

☐ Please send me Catalog Section #108
☐ Please send the complete catalog on the Tuthill line
☐ Have your representative call

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Tuthill Manufactures a Complete Line of Positive Displacement Rotary Pumps in Capacities from 1 to 200 GPM, for Pressures to 600 PSI, Speeds to 3600 RPM.

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PUMPS FOR YOUR PURPOSE

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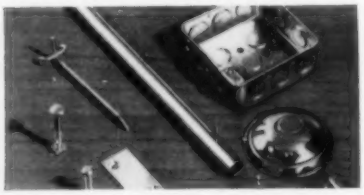
News about
COATINGS for METALS
Metallic.....Organic.....Decorative.....Protective

Plastisol gives metal products flexible armor against wear, corrosion

Chrome-like finishes produced at new low cost

For the first time, bright chrome-like finishes become economically practical for low cost zinc plated products such as electrical conduit and boxes, toy wheel goods, rough hardware and others. Economical chromate treating with newly developed Unichrome Dips is now being used to increase shelf life and sales appeal of even the most competitively priced products.

The new Unichrome Clear Dips operate at extreme dilutions. Make-



up costs are low. So are operating costs, even where dragout of solution during production is a factor. Costs for dip compound range between 30¢ and 60¢ per 1000 sq. ft. of surface treated.

A unique feature of these Dips is their stability, which saves through long "mileage" from the solutions, and consistent results.

Write Metal & Thermit for recommendation on your specific application. Virtually any requirement in chromate finishing can be met from the wide line of Unichrome Dip Compounds.

Unichrome is a trademark of Metal & Thermit Corp.

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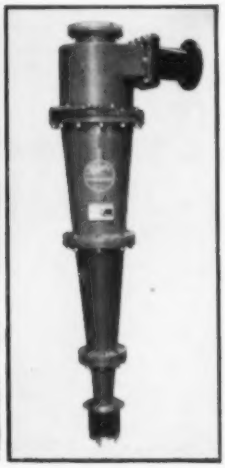


(Left) An example of the large work that can be protected, these metal cones for storage tanks are being sprayed by General Coating Co., Woodbridge, N.J., with "Super 5300" Plastisol for protection against abrasion and corrosion. **(Right)** Lined with Unichrome Plastisol, over 6000 of these centrifugal cleaners manufactured by Bauer Bros., Springfield, Ohio, are now defying wear and corrosion in paper mills.

Even ordinary metals protected with a coating of Unichrome Plastisol gain phenomenal ability to stand up in severe service. Engineers are finding in plastisols the means to improve product life, solve problems of wear and corrosion.

HEAVY DUTY MATERIALS

Sprayable Unichrome "Super 5300" Plastisol provides films up to 60 mils thick per coat. Unichrome "Series 4000" Plastisols form dipped coatings up to ¼-inch thick.

Unlike plastic sheet materials, plastisols conform to irregular shapes without air pockets or seams. The vinyl coating they form resists chemical solutions, fumes, moisture and other corrosives. Its pore-free thickness blocks permeation.

A Unichrome primer-plastisol system sticks tight, averaging a bond strength of 50 to 100 pounds per inch. It affords good flexibility to absorb mechanical abuse, resist abrasion to a remarkable degree.

SOME CASE HISTORIES

Liquid cyclones for removing dirt from pulp stock are subjected to abrasive, corrosive action of the stock. When made of stainless steel, bronze and chromium plated steel, they wore excessively. Lined with plastisol 4 years ago, these units have far exceeded life-expectancy of other materials.

Plastisol coated ducts exhausting strong acid fumes show no signs of deterioration after 4 years service.

Lining sand-blast barrels with Unichrome Plastisol increased barrel life twelve times for one user.

After six months use, plastisol coated agitators for chemical mixers show absolutely no wear. Rubber coatings, used previously, started to fail after only one month.

Write for detailed bulletins on Unichrome Plastisols or the name of the nearest applicator.

World's Fair FLASHBACK

NEW YORK—"A look into the future" was the theme of the 1939 World's Fair in New York, where the very latest in products, engineering ideas and concepts were mobilized for a panorama of bold and imaginative predictions. How successful have been the products shown at the fair for the first time, and how do the astonishing predictions of that year look today?

Product designers 20 years ago were talking about "television," "automatic transmission," "nylon," and "automatic production lines." They were looking into the world of 1960 and 1970 and predicting that steamships would be driven across the Atlantic by atomic energy; that we would be using television telephones, electronic cooking, and harnessing the sun's energy to power machines and generate electricity for the home and factory. Newspapers in 1939 reported that uranium bombarded with neutrons released atomic energy in great amounts and hinted of horrendous atom bombs in the future.

At the Fair, closed-circuit television was demonstrated. After the successful relay of signals from New York to Schenectady, engineers said that "network television will be developed soon." On opening day some 1000 viewers saw the first television newscast on screens that measured 9 by 12 inches. About 100 to 200 receivers were reported active that day.

General Motors "Futurama," a big attraction, focussed its attention on practical themes—Hydramatic transmission, for example, which appeared in some of the 1940 models. Since then, the Detroit Transmission Div. has made more than 8.8 million Hydramatic units, the great majority being installed in Cadillac, Oldsmobile and Pontiac cars. Hydramatic and Chrysler Corp's Fluid Drive, also introduced that year, showed the way to an increasing use of automatic transmission. Since 1948, Buick has produced 3.8 million Dynaflow units, and since 1950 Chevrolet has turned out 4.8 million Power-glide units. Other automotive items shown were sealed beam headlights, and safety glass also for auto models of 1940; vast highway networks to handle an expected 35 to 38 million cars by 1960 (total registrations today tops 56 million!); an overhead network of pedestrian walks bordering thoroughfares to permit expansion of existing traffic lanes; tubular lighting rimming graded road curves for night-driving safety; helicopter landing strips atop skyscrapers; and an "auto-gyro" car that could be flown or driven.

While shying from displaying "tomorrow's dream car," GM's Fisher Body exhibit boasted a "glass" car. Chassis, engine, and frame bracing were of standard construction. Fenders, hood, radiator, and body panels were made of a glass-like plastic. Its "transparent" car, said GM, could be driven on the highways.

Like GM, Ford spotlighted plans for a national highway network safety-engineered to abolish sharp curves, eliminate intersections and traffic lights, and to link industrialized farms to nearby factories. Ford also foresaw increased automation in production, but left to the future specific technological applications.

In aviation, jets were yet to become a household word. Plane makers, however, were heralding development a four-engine aircraft, envisioning non-stop transoceanic commercial hops at high-altitudes in planes having pressurized cabins, the latter development then in the research stage. To handle heavy air-age traffic, planners foretold of airports "floating" on a special-type foundation that would permit mobility and 360 deg. directional turning for meeting varying headwinds. At Chrysler's exhibit, the recently-formed American Interplanetary Rocket Society showed a "modern" rocket that had reached 250 ft before fizzling earthward.

Other displays by Westinghouse, General Electric, Bell Telephone, Johns-Manville, Du Pont, and other industry giants had a futuristic motif. Greater automation for steel-mill con-

NEW YORK—Visitors to the Fair's Chrysler Building couldn't miss the "interplanetary rocket" set up in the main foyer. This dream device, built by the American Rocket Society, was chosen for exhibition from three rockets that had been launched prior to 1939 because it most nearly resembled the public's conception of such a vehicle.

Another of these three rockets, launched in 1933, achieved an altitude of 250 ft and, though flight was terminated when its oxygen tank exploded, society members termed the trial run a success.

From such bare beginnings as displayed at the Fair the science of astronautics has evolved in less than two decades (see Product Engineering, Dec. 9, '57, p. 109).

trol was a Westinghouse feature that has evolved into Cypak static-control systems. These devices make it possible to build a steel-mill control system that will perform many steel-making operations without any moving parts. Also shown was the Precipitron electronic air cleaner now commonly used in many types of installations; an electric stairway and dishwasher, fluorescent lighting, and the laboratory curiosity, ultrasonics.

The GE House of Magic introduced the World's Fair sun motor and predicted that someday men would draw power from the sun in tremendous quantities, and make the sun a servant of man. In recent years a rash of new product ideas has stemmed from solar power: pocket-size cigarette lighters; grilles for beach picnics; portable radios; solar battery power for instrumented artificial satellites; high-temperature testing (8000 F) of materials, with the aid of large searchlight reflectors; battery recharging for emergency, and night telephone service (still a Bell Labs experiment); and a recent suggestion, a solar-powered water pump for irrigation systems. FM radio was introduced and demonstrated at the Fair.

At the Bell System exhibition hall, visitors placed long-distance calls to distant points in the country with the help of a special operator task force. More recently, Bell engineers have come up with direct distance dialing, a system using a 10-digit number that permits callers to dial distant points directly. By the end of this year, it will be possible to dial long-distance calls directly to some 35 million telephones from over 5 million telephones in about 500 exchanges. For the future, Bell scientists are experimenting with a radically different medium for transmitting TV and telephone conversations over long distances: a long-distance waveguide using hollow metallic tubes about 2 in. in dia. These may someday simultaneously carry tens of thousands of cross-country telephone conversations together with hundreds of TV programs. Beyond the prospect of improved transmission with the long-distance waveguide is the possibility of learning how to use tiny wavelengths on the order of one millimeter. Should this become possible, the waveguide of the future may be no thicker than a fountain pen and still carry tens of thousands of telephone messages.

Shown for the first time at the Flushing Meadows extravaganza was glass fiber, which, through the years, has developed tremendously in market application. Evidence: glass fiber, laminated in 150 layers and tapered in three directions is enabling Chance Vought to build nose control trimmers for its Regulus II guided missile, reducing landing speed by 30 mph. Nylon, by DuPont, also was shown for the first time. Its applications since then, from silk stockings to bearings, are too numerous to mention.

Should there be another Fair staged in the near future, indications are that an equally far-reaching range of futuristic products would be shown. Timken Roller Bearing and National Cash Register, both Fair exhibitors, cite examples of what they would probably be showing today. In 1939 Timken was talking in terms of 3 million-lb capacity for roll-neck bearings and accuracy to within a hundred-thousandth of an inch. Today they are making roll-neck bearings with more than three times that capacity and precision bearings many times more accurate. National Cash Register's 1939 display contained no electronic business machines or electronic data-processing systems that today would comprise an important part of a comparable NCR exhibit. Also, the concept of integrated data processing, in which various business machines are linked together by a common "language" to provide a greater degree of office automation, was not illustrated at the World's Fair. In contrast, a similar display today would inevitably include, in addition to electronic machines and systems, such devices as a punched-paper recorder that can be linked with cash registers, accounting machines, and adding machines to preserve essential data for subsequent automatic processing, either by electronic or electromechanical means.

TV cameras, then and now . . .

Nation's first tele-newscast was sent over closed circuit by camera at left in 1939. The RCA-developed unit heralded today's multibillion-dollar industry when it was used in World's Fair opening ceremony. Highly simplified black-and-white studio camera shown at right is the newest descendant.

Vive la Porte!...

PARIS—French ingenuity is solving problems of noise, dust, heat-control, and traffic behind flexible doors. And in such different places as hospitals, factories, laboratories, mines, and terminals.

An English development, impact-actuated flexible doors (left photo) are a welcome alternative to portals opened by photo-electric cells, contact switches or other gadgets subject to power failure and high installation and maintenance costs. Flexible doors can be installed inexpensively and have few maintenance problems.

Transparent closures, (right photo) popular in France and much of Europe, come in different degrees of transparency. Some have glass-door see-through, others show objects on the other side only as a mass. They are soundproof, resistant to heat, cold, and acid and swing in or out under impact easily—tension at hinge points can be adjusted quickly to suit traffic patterns. Coefficient of elasticity limits over-all dimensions to 10 ft high, 7 ft wide. This shape can be varied, however, as long as door area is held to 70 sq ft.

Opaque flexible doors, also popular, are usually of heavy rubber with portholes mounted in plastic or aluminum. Porthole material is the same as that in the transparent flexible door. Each flap of the opaque door has a nylon or cotton webbing that assures alignment in closure.

These doors are made in many colors and sizes. They can also be made resistant to corrosive atmosphere.

Big Future Seen for Midget Jets

NEW YORK—Voids now existing in the realm of jet flight will soon be filled by a new family of low-weight, high-performance turbojet engines, according to Louis W. Davis, assistant to the vice president, Engine Div., Fairchild Engine and Airplane Corp. Speaking before the American Society of Mechanical Engineers, he said that small turbojets in the 1000- to 3000-lb thrust range will enable designers to create new types of fast, versatile military and commercial aircraft heretofore impractical to produce with large, two-ton jet powerplants.

Small turbojets now emerging from test facilities at Fairchild's new $10 million development and production plant at Deer Park, L. I., promise immediate thrust-to-weight ratios of 8 to 1 and a near-future potential of 10 to 1, compared to larger jet engine power-to-weight ratios of 3 or 4 to 1, Davis noted. Currently, Fairchild is pushing to completion development of its new J83 turbojet, designed as a primary source of power for manned aircraft. General Electric Co. is also working on a new, small turbojet, the J85, which reportedly has a comparable thrust-to-weight range to J83.

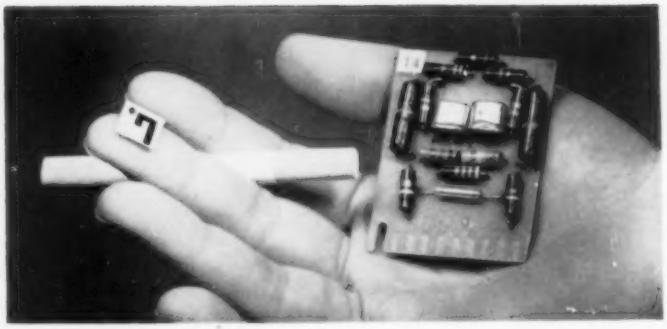
Among new plane designs cited by the Fairchild executive as promising substantial savings in the increasing cost of producing, operating, and maintaining large commercial transports and complex military air-weapons systems are: small and intermediate personnel transports; lightweight supersonic jet-readiness trainers; lightweight subsonic navigation trainers; light supersonic interceptors armed with missiles; turboprop aircraft with jet assist; high-speed supersonic STOL (short take-off and landing) transports for long-haul command communications, and liaison VTOL (vertical take-off and landing) craft for short-haul missile management and communications. Such aircraft, Davis said, are important to SEATO and NATO countries and our Air National Guard.

By utilizing smaller turbojet units, Davis pointed out, present-day costly, complex, and hard-to-maintain ground support equipment such as starters, tugs, fuel tankers, fire trucks, rescue apparatus, runway sweepers, etc., could be redesigned for maximum economy and ease of handling. He noted that planes equipped with small jets can be designed with built-in starters and relatively small tugs or jeeps could tow them. Also, short take-off and landing capabilities of smaller aircraft will mean less-complicated deceleration systems and consequent savings in rescue apparatus.

In addition, Davis noted that present costly specialized tools needed for handling and servicing larger jet engines can be eliminated, in many cases using smaller jet units. Four men, he said, can carry a small engine without special handling equipment, thus eliminating the need for large overhead cranes and special dollies.

Projecting ahead 15 to 20 years, Davis envisioned a missile-weapon equipped military almost wholly dependent on fast air movement for transporting personnel and materiel. In such a climate small turbojet-powered aircraft would play a vital role in carrying missiles and men at fast speeds to widely dispersed launching sites.

Smaller Transistors —Smaller Missiles



WASHINGTON — Micro-miniaturization is enabling Army scientists to reduce transistor size, which means less bulk for the electronic memories of guided missiles and aircraft.

The technique uses printed circuits to cut transistor size (see photo right) to about 1/20-in. wide and 1/100-in. high; 200 of these printed circuits can fit into 1 cu in. Process appears ideally suited to automation and rapid, precision mass production of transistor systems at low cost. Reliability and resistance to shock and vibration should be increased.

In addition, the technique opens a wholly new front in terms of small assemblies of circuits for civilian use. Costwise, the microminiaturized components are expected to be competitive with tubes.

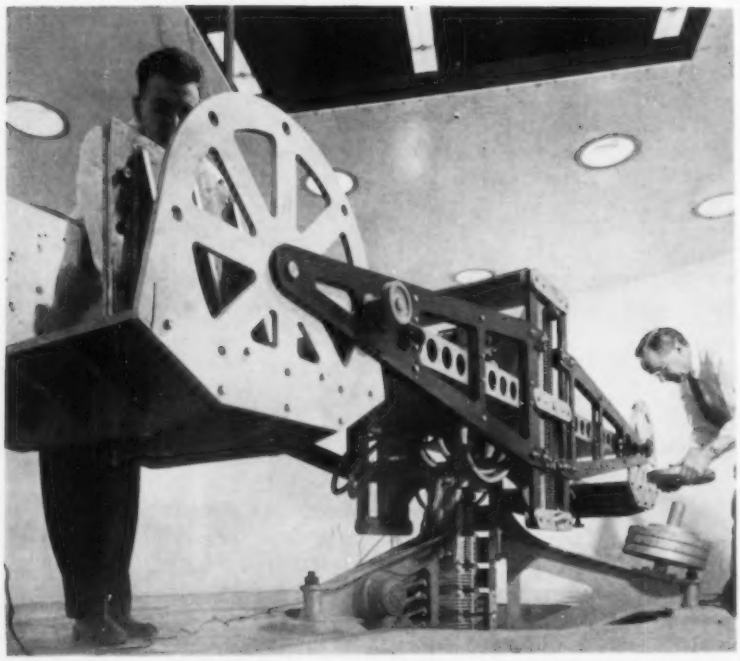
Though still in the research stage and under government patent, the new development is not classified. Instead it's being made available to industry to devise applications. Process was invented by Dr. J. W. Lathrop and James R. Nall, of Army's Diamond Ordnance Fuze Laboratory here.

Research in this field started with development of photolithographic-fabrication techniques for making transistors. This led to this latest break-through, making transistors an integral part of printed circuits.

The new transistor method starts with a tiny wafer of the metal germanium. Photo-sensitive film provides precise positioning marks on a ceramic plate for the pinpoint electrodes of the transistor. The electrodes are formed by vapor deposit.

The inventors say the most interesting aspect of photolithographic techniques as applied to transistor fabrication is the ability to "print" the leads by evaporation and deposition of aluminum. In this process a coat of resist is placed over the finished transistor and exposed to leave free only the areas directly over the emitter and base contacts. Sometimes an additional layer of gold is electrolytically deposited in these areas to insure good contact.

The transistor is then soldered to a thin base plate and inserted into a ceramic printed board. Gaps between the board and the die are filled with insulating cement which fastens the transistor to the board. Crude masking makes it possible to vacuum-deposit aluminum leads, which connect the printed wiring on the board with the contacts on the pedestal. The leads have a conductivity of a 0.0006-inch wire.



Electronic gear goes for spin . . .

in giant centrifuge to qualify for missile flight at General Electric's Missile and Ordnance Dept. While riding the machine two 300-lb objects can be accelerated rapidly enough to experience a force of 100 G's.

BITS AND PIECES

West German scientists can be mobilized for any expanded NATO military effort in about 90 days' time, according to recent reports. These scientists would be drawn from R&D sections of the leading West German industrial firms now doing nonmilitary work. A nucleus exists in Germany to push forward on the most recent projects now being explored in the US, Britain, and France. Chief problem until now has been transmittal of highly classified US data. This, because of a poor security system there. . . . **Open multicell honeycomb** screen is being used to intensify television images for daylight viewing. Contrast is sharply increased by the honeycomb structure, which acts as a hood or light shield to limit entrance angle of straight-line light. Optimum viewing angle is 80°, or 40° each side of center. Oscilloscopes also stand to gain by this development. . . . **Machine tool shipments down 30%**. . . . Stretchouts and cancellation of military projects, plus the cutback in spending by automobile companies is expected to lower machine-tool shipments by 30% from this year's $870 million total. . . . **At a recent Aviation Writers meeting** in Los Angeles, George Sutton, chief of preliminary design, Rocketdyne, said, "We know little of what the Russians are doing. They think they are five to ten years ahead of us. One said to me at the conference in Barcelona, 'You Americans can afford lots of projects. We Russians can afford only two, and those have to work.'"

Build Missiles on the Moon

At the same writer's meeting, Robert D. Wilson, of North American Aviation's Missile Development Div. said, "All the materials needed to build a missile are available on the moon, as minerals. This is conjectural, but appears to have many advantages arising out of the greater requirement to get materials out of earth's gravity. The power needed for a moon-to-earth vehicle is a small fraction of that required for an earth-to-moon vehicle." Dr. Norman Parker of Autonetics called navigation the 'most neglected area, and said that the accuracy required to hit the moon is the same needed to hit Los Angeles with a 2,000-mi missile.

Brazil's Auto Industry Sprouting; Parts Makers Needed

RIO DE JANEIRO—Brazilian president Juscelino Kubitschek thinks his country might be exporting vehicles and parts by 1961, thanks to special laws designed to bring in automotive manufacturers. Nine production programs are already underway for trucks, cars, jeeps and utility vehicles. Plans of 16 more companies are being studied. These hope to get into the race before the Dec. 31 deadline, according to Sidney Latini, who heads up the GEIA (Grapo Executiva da Industria Automobilistica). Latini says that because Brazil can hold only so many automotive manufacturers, companies with the foresight to come in during GEIA's first year should be "protected" from new competition after Dec. 31. Not all of the 16 programs being studied (some are from local firms with plans for new-type vehicles) will be accepted. Green lights will flash only for those that fit Brazil's needs and can move fast enough to meet the 1961 deadline of 96% Brazilian-made vehicles, according to Latini.

These are the new programs competing for a go-ahead (some haven't been officially presented):

Chrysler—Chrysler struck out on a possible truck-production deal with Brasmotor, a local company. Brasmotor will make Whirlpool appliances and continue to sell Chrysler parts. But Chrysler is thinking of making a specially designed Plymouth car for Brazil.

Willys—Jeeps are already in full production in Brazil and are right on schedule for nationalization of parts. But Willys has shown interest in making a special passenger car.

Simca—This French company has been marking time for possible entry into Brazil's auto-truck race. Nothing definite yet.

Borgward—GEIA says Borgward is definitely interested in coming in. Its "Isabella" model is still under study.

Saab—has exported cars to Brazil but so far has done no local production. But the company is considering it.

Mercedes-Benz—was the first to enter under GEIA's setup with plans for heavy diesel trucks. It was also first to use locally-made engine blocks. Now M-B wants to make its 180 diesel car in Brazil. Because of its already functioning truck manufacturing plant, M-B might well get the nod.

Romi-Isetta—The little cars, now being made near Sao Paulo, are not under GEIA's import-benefit plan but new plans for production of bigger (four seaters) Isettas might well be. Isetta also wants to make trucks and station wagons.

With all these automotive production-line companies lining up, competing to squeeze in under the wire by the Dec. 31 deadline, auto-parts makers around the world have drawn an erroneous conclusion that all auto-industry manufacturers will be shut out after the deadline, GEIA officials said.

The Dec. 31 deadline does not apply to auto-parts makers, according to Latini. GEIA "will be in critical need of special auto and truck-part production and manufacturers of these parts will get speedy action and special attention on any proposals they make."

Here is the list of "critically needed" parts for Brazilian manufacture as outlined by GEIA engineers: Crankshafts, connecting rods, camshafts, valve rocker arms, intake and exhaust valves, and special shops for gear machining.

GEIA officials claim that the big three for critically needed components are press shops, forge shops, and toolrooms. A large Cleveland drop-forge company is considering an agreement with GEIA.

More plants are needed to make other engine parts: connecting-rod bearings, crankshaft bearings; intake and exhaust systems; fuel-system special parts; ignition-system special parts; lubrication system (oil pump); cooling system (especially thermostatic valve); clutch; transmission; drive and coupling shaft; axles (a standard axle for Ford and G.M. to speed up nationalization and cut down waste); electrical equipment; steering gear; chassis frame (production starting but more needed); body makers (especially autocars); accessories (instruments, ammeter, oil-pressure gauge, thermometer, speedometer etc.); brake system (hydro-vacuum, airbrakes).

now . . .

PRECISION JEWEL BEARINGS

help to produce

PRECISION POTENTIOMETERS

Waters LO-TORK Potentiometers with Bird Jewel Bearings are used on U.S. Air Force Supersonic bombers.

Here's how Bird Sapphire Jewel Bearings helped a prominent manufacturer of electrical instruments to make a major product advance.

Waters Manufacturing, Inc., manufacturers of precision potentiometers, were asked to design a miniature potentiometer with minimum torque and reliable operation when operated in a contaminated fuel mixture. The result was the new Waters LLT ⅜ LO-TORK potentiometer with jewel bearings — an entirely new concept in miniature potentiometers.

Bird Sapphire Jewel Bearings are specified in the new Waters LO-TORK Potentiometers because they provide higher accuracy and longer instrument life. Waters LO-TORK Potentiometers with Bird Sapphire Jewel Bearings stand up under even the most rugged accelerated corrosion tests conducted by the Armed Forces. In fact, Waters LLT ⅜ potentiometers are now being used in fuel flow meters where they must withstand the rigors of jet fuel.

Bird Precision Jewel Bearings have been used by the foremost manufacturers of electrical, aircraft and timing instruments and recorders. They are available in a wide range of standard types, sizes and complete assemblies — or custom-built to your specifications.

If your product design calls for jewel bearings, our engineering staff is at your service. A request on your letterhead for Bulletin 100-6 will receive our prompt attention.

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Sonic Waves May Upgrade Uranium Ore

MOHAVE DESERT – High frequency sonic waves and static electricity are being used in a revolutionary process to upgrade uranium ore. Tests are being conducted in an experimental mill set up by Arthur G. Dearing, president of the International Mining Co. of Greenville, Ohio.

According to Dearing, sonic waves, created by an "audio generator," shatter the ore which is further broken down by a static electricity process using more than 30,000 volts.

Test runs conducted during recent months on ores from Coso Uranium Co. and the Kern Mines have indicated that separation can be effected, but Dearing said he was not completely satisfied with results. Further evaluation tests are being made by International Mining engineers in Ohio.

Dearing who developed the process, reported that other metallic ores are being considered for testing, but emphasized that the process is still very much in the experimental stage. He said that 5-ton samples of many low-grade ores were considered for testing.

Electronics Checks Aircraft Vendor Specs

MARIETTA, GA.–An ultra-sonic test tank and another electronic inspection machine that "blows up" small aircraft parts to 100 times their size are two devices Lockheed Aircraft Corp. has installed here recently for critical examination of vendor parts and forgings. The test tank gives inspectors a look into the molecular composition of forgings and extrusions. It uses an electrically-pulsed crystal as its "eye". Shapes are immersed in a tank and subjected to bombardment of ultra-sonic waves from a crystal. Echoes from the sound waves bounce back from the front and back surfaces, or from any internal defect in the forging. The tank's heart is an "immerscope" that not only registers sound waves, but also analyzes the composition of the metal being tested and pinpoints defects. Another machine, a "contour projector", multiplies the size of small parts by as much as 100 times and projects the enlargement on a mathematically divided grid. The "blow up"

permits inspectors to see at a glance if the vendor has met required manufacturing specs.

World's Largest Vacuum Arc Melting Furnace

AKRON, N. Y.—A 38-ft-high, consumable electrode furnace, largest commercially built vacuum arc melting operation in the U.S. is being operated at Carborundum Metals Co. here.

More and more alloy steels are being melted by the vacuum arc process that eliminates crucible contamination by melting the metal electrode in a water-cooled copper crucible, preventing chemical reactions.

Built by Westinghouse, the furnace allows for gas removal by vacuum action, exhibits a cleaning effect by floating impurities to the top of the ingot and redistributing sulfides into more uniform pattern.

Achieving better ingot uniformity through the process's rapid freeing rate, the furnace double melts zirconium metal to yield ingots 16 in. in dia and weighing more than a ton.

Plotting '58 Trade Fair

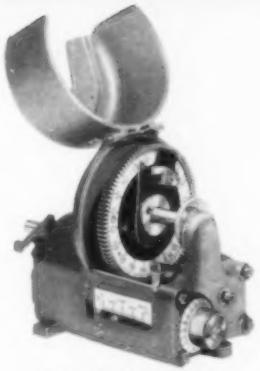
THE LATEST DEVELOPMENTS in high-quality imported machinery and precision tools will be featured at the 1958 U.S. World Trade Fair at the Coliseum May 7 through 17. Along with these will be sections for power equipment, electronic equipment, scientific instruments, electrical equipment and motors, basic materials. Fair officials predict an increase over this year's 700,000 attendance.

Westinghouse in Hall of Fame

NEW YORK—The bust of George Westinghouse has joined seven other great inventors in the circle of 86 Americans at N.Y.U.'s Hall of Fame.

In the commemorative address Herbert Hoover said of Westinghouse: ". . . a rare combination of a great inventor in the mechanical field, a great manufacturer and a great business executive. As an inventor, his first startling invention was the air brake, which is used on practically every American railway car and, in fact, over most of the world. He was not content merely to file a patent and hope someone would use it. He built a great factory to produce it."

COUNT-REGULATED CIRCUIT CONTROL WITH AUTOMATIC RECYCLING

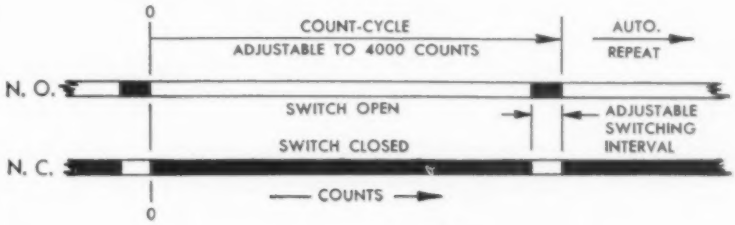


CYCLO-MONITOR
Write for Bulletin 202-1

CYCLO-MONITOR

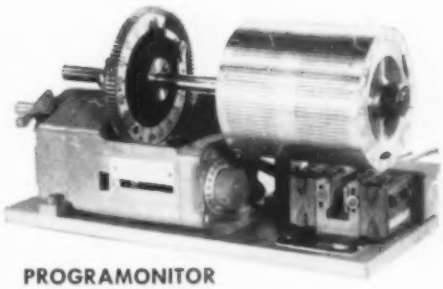
COUNTS: Shaft Revolutions
Lever Strokes
Electric Impulses

CONTROLS: Machines and processes on a repeat cycle basis. No reset required. No pause or lag in recycling—even at continuous speeds. Positive gearing throughout. Integral, SPDT switch transfers as shown in typical cycle diagram below:

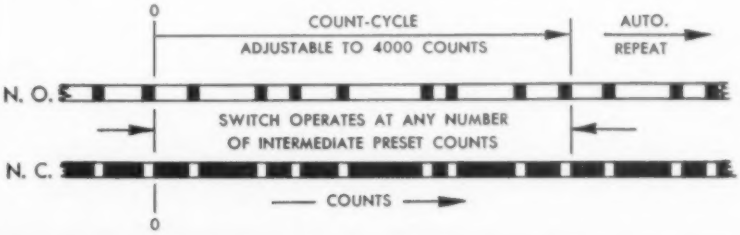


PROGRAMONITOR

An advanced recycling, circuit-controlling counter for complex and irregular switching patterns with any number of intermediate switching points. Complete flexibility for pattern changes. Automatic, instantaneous recycling.



PROGRAMONITOR
Write for Bulletin 505



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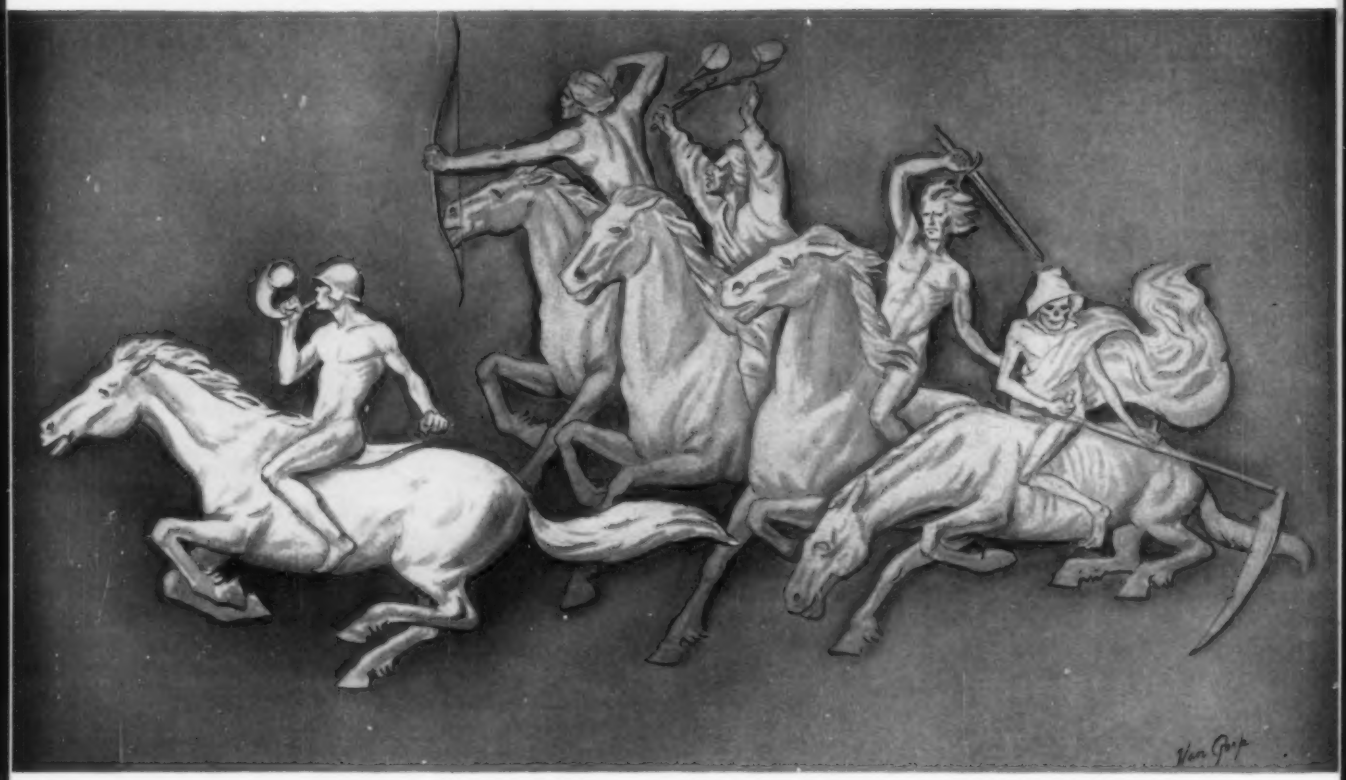
THE FIFTH HORSEMAN CAN TELL US . . .



WHY WE NEED TO KNOW

Philip Wylie told, some years ago, the legend of the Fifth Horseman. He rode ahead of his brothers, warning the people of their coming. But they laughed, and refused to believe, so when Conquest, Slaughter, Famine and Death ravaged the land, the people were caught unprepared. Then when the Fifth Horseman rode back sadly over the devastated land, the people reviled him, and shouted, "Why didn't you warn us!" Infuriated by such ingratitude, he rode with his brothers, and was more terrible than any. . . . His name—Reality.

This story comes to mind today as we see tons of ink put on miles of paper to report every rumor, opinion and tall tale about the satellites, regardless of source or authenticity. Sputnik I was spying on us, carrying a hydrogen warhead, guiding bombers, mapping the world. The dog in Sputnik II was to be returned to earth, was mercy-killed, and so on.

As James Gould Cozzens has Julius Penrose say in his recent novel, *By Love Possessed:* "We're in an age of capital F Feeling—a century of the gulp, the lump in the throat, the good cry. In other ages, sentimentality seems to have been the despised pleasure of the underwitted. We've made sentimentality respected. The grave and learned are no whit behind the cheap and stupid in their love of it. Newspapers stop their presses, the broadcasters interrupt their broadcasts, so it may be immediately available. In plays and motion pictures, in contemporary literature, I find it, scarcely disguised, standing in puddles."

Scareheads and commentators berated the Russians for launching the sputniks "without warning"—even though they had agreed previously that they would report only when they had a satellite in orbit. The popular attitude has been the Soviet scientists broke faith—that they lied or cheated.

All this is pure hooey, an outgrowth of plain laziness, and resultant surprised indignation on the part of these supposed seekers after truth—the popular press. They, and the lay public, have never bothered to learn any foreign language or other people's attitude of mind. Their attitude is that anyone who neither speaks nor thinks American must be a dolt. They wouldn't translate readily available Russian magazines —and wouldn't believe anyone who did.

The news sources—and the American public—have somehow arrived at the firm conviction that we can do anything better than anyone else, and do it first. They've conveniently forgotten such recent military advances as the bazooka, the high-velocity gun, the snorkel, the jet engine, and the rocket, (even ours, via von Braun, et al) all of which was learned about the hard way from our German enemies in World War II.

Here we had only a popular language difference and bar, for German is one of three acceptable scientific languages. Many American scientists and engineers can–and do–read German material, and learn from it.

They've also forgotten that Fermi of Italy and Bohr of Denmark were involved with the A-bomb, Teller of Hungary with the H-bomb, Whittle of Britain with the jet engine, that both radar and sonar came from England, as did the idea for the workaday Landing Craft, Tank. Teller testified recently that, in lagging behind Russia in science, the US has lost a "battle more important and greater than Pearl Harbor."

Details of the Russian scientific and technical buildup have been available for years. Harvard University and various government agencies have translated and made available Soviet statistics and articles; our armed services have translated (and promptly classified–Lord knows why!) technical reports. **Product Engineering** itself detailed Russian schooling of engineers and scientists as long ago as February, 1953. The article was obtained by the obvious expedient of taking a series of questions to the Soviet embassy, then organizing the replies to make a sequential story. That article was howled down and derided as propaganda; in fact, there were shouts of "Pink" and "Fellow traveler" led by those who hadn't thought to ask.

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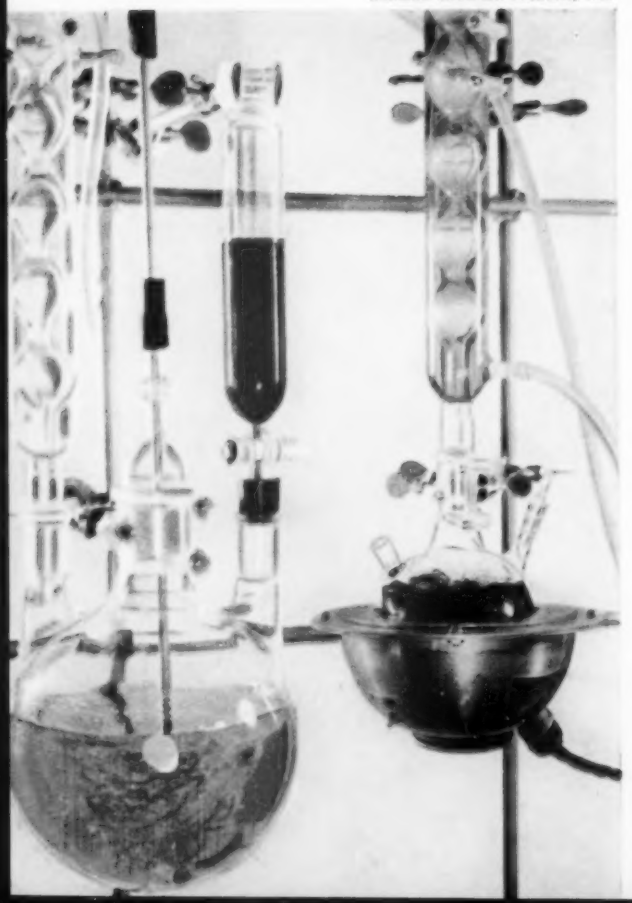

Trevor Gardner warned that Russia was ahead of us in missile development when he resigned from our missile program a year ago. Dr. Clifford Furnas reportedly resigned on similar grounds. Professors and scientists have reported Soviet technical advances again and again.

The Soviet powers-that-be make no such mistakes. They do not undervalue American reports and literature. Every incautious remark made by a Congressman seeking publicity, every available technical report, is promptly translated into Russian and made available to technicians. When Burnham Finney, editor of *American Machinist*, interviewed the Soviet minister of machine-tool production in London a year and a half ago, he was startled to hear that minister—who neither read nor spoke English—make reference to articles that had appeared in *American Machinist* just four weeks before. This despite the fact that the magazine is not circulated in Russia. At the London Conference on Lubrication and Wear (Nov. 25'57, p. 82-83), USSR authors cited US authors 13 times, but US authors cited no Soviet references at all.

Back in 1952, the USSR established the All-Union Institute of Scientific and Technical Information in Moscow. It now has a permanent staff of 2300 translators and abstractors, who, with some 20,000 part-time specialists, translate and publish in Russian the scientific and technical literature of 80 countries. There are some 13 abstract journals carrying over 400,000 abstracts annually. Even though none are addressed there, the Institute abstracts more than 1400 of our 1800 scientific journals. Because they have been taught to read constantly, and as a result of this service, **Soviet scientists know more about our scientific progress than we do.**

Some 400 Russian magazines of the 1200 total, popular and technical, are readily available in this country. They tell (as ours do) what Russian scientists and engineers are doing. But the tendency has been to underrate what they say, and to do no systematic job of translation. Some technical societies, some private companies, some publications, translate and abstract Soviet material, but on a largely haphazard basis. The Commerce Dept. requested a law in 1950 to search out and catalog scientific and technical information from foreign and domestic sources. Some 35 people in the Office of Technical Services act as a clearing house, reporting on only 30 Soviet magazines in a limited way. The rest gather dust in the Library of Congress. At least 200 should be translated. (Asst. Defense Secretary Snyder has promised more extensive translations.) National Science Foundation reports this case: An American company spent $200,000 and five years doing some electrical research **previously reported in full in a Russian journal.** NSF is now spending $107,000 a year for translation of Soviet material. Translations are also available from the John Crerar library in Chicago.

D. H. Radler of the Purdue Research Foundation docu-

(continued on page 28)

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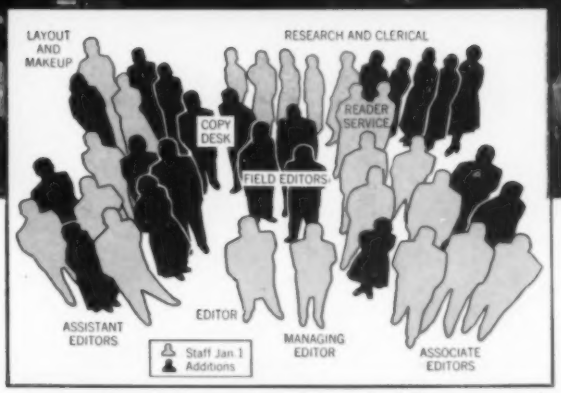

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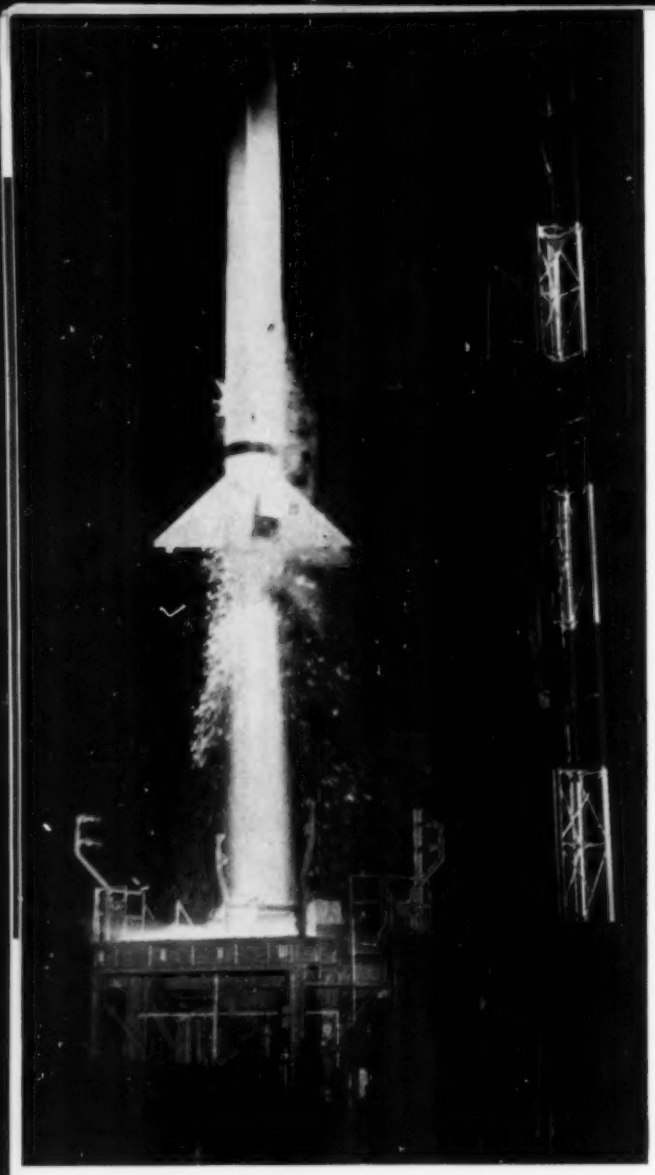


WHY WE NEED TO KNOW (CONTINUED)

mented the availability of advance data on the satellite launching: The June '57 issue of *Radio*, a Soviet journal, gave virtually every detail of the earth satellite. Many specifications of sputnik were repeated in the August issue of *Tekhnika Molodezhi*, a Russian science magazine for young people. But even in mid-October, our best dailies were still decrying the "Red blanket of secrecy!"

• V. Vakhnin indicated the sputnik orbit in one *Radio* article, A. N. Kasantsev, in another, outlined radio tracking, gave the two frequencies, the pulsing of signals, and how to calculate ionospheric disturbances by measuring Doppler effect.

• The August article in *Tekhnika* spelled out the problems, including correlation of outbursts on the sun with changes in the electrical-charge distribution of the ionosphere. It indicated one circuit of the satellite would take 100 minutes (a 4% error, as it turned out). The lower frequency of 20.005 megacycles is a good choice for studies of the ionosphere, the higher (40.002 megacycles) is adequate for tracking.

All three articles stressed what can be measured by tracking the satellites—flatness at the poles, bulge at the equator, distribution of dense materials within the earth, atmospheric dust at high altitudes, density of the upper atmosphere. These are exactly our own scientific objectives—to "peel the skin off this big apple we call Earth, to acquire fundamental new information about the universe . . ." in Mr. Radler's words.

Remember how everybody pooh-poohed Hitler's plans, exactly outlined in *Mein Kampf*? Consider also the stories on what our "scientists" thought when Sputnik I orbited. The headlines went to the ham radio operators, the saucer seers, the publicity seekers, because their "news" was more sensational than the facts collected from scientific sources by the Naval Research Lab. Actual information was limited, at least initially, and much of it was quite technical.

Further, who troubled to ask questions at the High Altitude Observatory of the University of Colorado at Boulder, which specializes in solar research and is constantly tracking stars by radio telescope? About October 1, this observatory completed installation of two large radio-telescope "corner reflectors", arranged as an interferometer in a NE-SW line and set to 20 megacycles. When Sputnik I was launched Oct. 4, its orbit was polar, inclined at 65° to the equatorial plane and it was beeping at 20.005 megacycles. Thus the new HAO setup was zeroed in with perfect equipment!

HAO started tracking Sputnik I immediately, recording 47 of the first 50 circuits for periods of an hour at a time. **By 5 AM, MST, the next morning, HAO scientists predicted time of passage over Boulder within 3 sec, direction within 1.5°, altitude within 15 miles.** By the next day, they had more information on the satellite and the ionosphere than any other Free World lab, and had transmitted it to IGY headquarters at the Naval Research Lab and the Smithsonian. They soon found that:

1. The orbit was within the ionosphere much of the time (as close as 120 miles to the ground).
2. That spin of the satellite and interference of the atmosphere produced flutter in signals.
3. That apparent "patches of ionization" caused variations in Doppler effect and signal strength to receivers even fairly closely spaced.
4. That they had "enough information to keep busy . . . on analytical work for six months."

The U.S. stations actually set up for tracking our own satellites ("and the Russian, if they ever get one up") also tracked Sputnik I as soon as they recovered from their surprise and got their frequencies in order. They, too, collected invaluable data, enough for months of analysis (see p. 14).

So here we have the spectacle of our experts being helped by Russian scientists. This goes down hard with Americans. What's more, the public has been taught that every trial must be a success—viz: the screaming headlines and radio and TV commentators' "learned" opinions when a missile fails. (The Russians had 11 aborts before their first successful ICBM. They even have their jokes to match our "muttnik" and "poochnik". A current one: "*Sputnik* won't come down; *Vanguard* won't go up!")

Information on Russian science and engineering is available—has been all along. Some 400 different Russian maga-

zines are exported–and received in the U.S., as previously mentioned. But there is the language barrier, affecting science, engineering, diplomacy, government, and social understanding.

In some ten years of handling translations of various Russian technical articles at McGraw-Hill, we have at times been irritated by the constant injection of political ideology in otherwise straightforward material, but just as often impressed by definite leadership in ideas. The evidence is–and has been all along–that the Soviet technical advance is not on a crash-program, specialized basis, but is spread across a broad front.

It is apparently standard practice to apply Soviet resources in the direction of military development (see comparison of U.S. and Russian tanks, guns, and other weapons–P.E.–p. 124-129, Feb '51; p. 134, Nov. '51; p. 194, Aug. '52; p. 154-159, Oct. '52; p. 199, Mar. '53). Other areas are merely

It ain't what we know that's important; it's what we know that ain't so.—ABE MARTIN.

kept abreast by copying the best foreign thinking available. For example, Russian automobiles are merely copies (Nov. 11, p. 111) and control equipment, some machines, many domestic products, are likewise.

Not so in military hardware. Ideas there may start from our designs, but there are also very modern Russian designs. All are in the most advanced weapon types–in rockets of all sizes, rocket launchers (even to portable launchers for IRBMs!), planes of all types, tracking, and the like. And there is more to it than design–the hardware has been prototyped, debugged, and built. One expert tells us that, while Soviet steel output is only half of ours, his best guess is that they match us, ton for ton, in the amount put into weapons. The civilian economy goes without–but weapon technology stays in the van. This single-mindedness is characteristic of nations not in the van, and burning to be there.

The essential point is that we are, and have been, at war for some time. It is a new kind of war, of words, threats, counter-threats, lab announcements, technical demonstrations rather than shooting. But war it is, nonetheless, whether or not we recognize it.

There are two phases to this war, one short-term, one long-term. The short-term conflict is in advanced hardware. Several of our experts estimate the Russians have a 3-year advantage in rocketry and missiles (corresponding quite closely with our 1949-52 holdup), possibly some advantage in some phases of tracking, nuclear warheads, some plane types. We have atomic submarines, germ warfare (even though nobody admits it publicly since the Chinese made their inaccurate but propaganda-wise germ-warfare accusation in Korea), better hand weapons, probably better bombs, and better instrumentation in most cases.

With Russia ahead in rocketry by three years, it will take us five or six to catch up. This, under the stimulus of current aroused public opinion, will probably be done. But meantime they may pass us on big helicopters, heavy bombers, and *peaceful* utilization of the atom if we're not careful. The latter possibility, incidentally, could provide the next Soviet propaganda campaign.

This short-term conflict can break into open war at any time, of course, but it is unlikely. If this is so, our indicated path is to make the "hard choices" President Eisenhower suggested in his second speech. We must abandon or reduce some pet projects to apply available funds to defense. Among current expenditures sure to be questioned are the public-works program, the subsidies for farmers, small businessmen, and even bigger businessmen, aid to able veterans, for welfare, for foreign non-military aid.

The second phase of the current "war" is actually the more dangerous because it is less visible. This is the marshalling of Russian technology to challenge our own, the preparation of more scientists and engineers, more manufacturing capacity, more natural resources.

The President's second speech to the nation indicated some awareness of this problem, and a determination to undertake more basic research and produce more "Einsteins". Here is a basic need—to overcome the disrespect for learning in America. It is easy to make science merely a "fountainhead of gadgets", an utterly utilitarian process which produces only toys. The emphasis is on *results*, not on *research*, because there is more human interest there. In effect, there is no respect for science or technology as such, but merely for what they can do to produce added luxuries. **The ultimate product of technology becomes the gadget.**

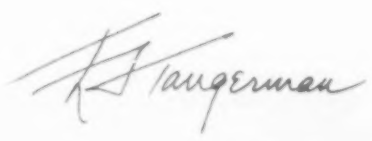
The only possible solution is education. It is time to provide ourselves with the judgment to avoid panicking at every shadow. We need more real support for science. The uncommon man among common men must be respected, rather than merely tolerated. This requires that science be presented as a serious intellectual adventure, undertaken to remove man still further from the other animals. Our preoccupation with comfort must be replaced with a preoccupation with ideas, or at least an appreciation of them.

We can't make our savants into heroes, as the Russians do. But we can respect intellectualism rather than to attempt to "debunk" it. **We can place the emphasis on knowledge** rather than on wealth or social position, as we have done for so long. If we do that, our scholars will find scholarship more attractive. We need to sort out the exceptional student and push him along, not submerge him in a welter of common ones (see Dr. Suits' opinion, next page).

We need also to select the student capable of engineering or science and see that he has his chance at them even though financial help is needed. The National Scholarship Fund, recently set up, is a step in this direction. And we need to be sure that math, physics, and science teachers at the secondary-school level know their subjects. Pay for good teachers must go up to draw top men to the field.

These steps have been taken long since in Russia–there the "egghead" is given both intellectual and material rewards. (The Academy scientist receives the equivalent of $50,000 a year.) As Mr. Radler says: "Perhaps the deepest meaning of the radio signals from the sky is that America must learn not only to tolerate, but to respect and wilfully to produce more uncommon men."

We must, in short, face *Reality* now, and believe it—or it will ride against us as the Fifth Horseman.



BASIC RESEARCH—*WHAT, WHY, HOW*

Many people feel with former Secretary of Defense Charles E. Wilson that, "Basic research is when you don't know what you're doing." Because it has suddenly become so important in defense news, a more accurate definition should be presented. Dr. Guy Suits, vice-president and director of research for GE, provided one on Nov. 25. It is, simply: **Basic research is the process of learning new scientific knowledge.**

It is thus *not* an antidote for sputniks, at least not immediately, for it is aimed at pushing back the technological frontiers by men who do not visualize a "practical result" in what they do—they are simply intensely curious about nature.

Said Dr. Suits, in relating basic research to national defense:

"New industrial technology is becoming a progressively more important source of innovation in products, services, and manufacturing methods. Because new or improved technology usually originates in new scientific facts, which come from basic research, this activity is an important source of competition. Without it the business may fail or lose position.

"A similar competitive drive explains the importance of basic research to defense. All modern weapons depend upon technology, some of it exceedingly complex, and all of it subject to rapid obsolescence as a result of new scientific discovery. The time is long since past when new weapons originate in blacksmith shops. They will to an increasing extent originate in basic-science research programs, and we must be certain that no political competitor forges ahead of us in research.

"That this is a real possibility is indicated by the sputniks—all five of them. I list five sputniks because five very significant Soviet events have raised clear warning flags that this competitor is rapidly forging ahead, scientifically and technically. These events have been:

(1) detection in 1949 of the first Soviet atomic bomb, much earlier than anyone predicted;

(2) announcement, in 1953, of their first hydrogen bomb;

(3) gradual realization, around 1955, of the fact and basic importance of the tremendous programs of Soviet technical education and scientific research;

(4) recent achievement of the first successful satellite;

(5) recent successful launching of a 1000-lb satellite into its orbit.

"Events (4) and (5) are flying blessings with silver linings, because they have finally shocked public consciousness into a feeling of impending doom. Because of them we are now engaged in a critical examination and appraisal of our whole national posture on science and technology. To do so thoughtfully requires a study of not one but *all* of the aspects of our dilemma which in aggregate add up to the problem of national survival in a scientific age.

"We must start our inquiry far back in the educational system. We do not, for example, except by accident, detect technical aptitudes in our young students. How many potential Langmuirs and Einsteins have been lost to science no one will ever know. If we did detect these aptitudes we wouldn't know what to do about them, for our technical subjects are taught with so much apology and so little inspiration that only the hardiest enthusiasts among our students survive the ordeal.

"Could it be that our preoccupation with pedagogical requirements has left no room in the curriculum for specialization in science and technology on the part of our teachers? **Among the 400 outstanding research scientists at our Research Laboratory at The Knolls, for example, there are only a very few who could obtain regular employment as high-school teachers!**

"Because Soviet Russia is training three times as many scientists and engineers as we are, it would be easy to come to the conclusion that we should immediately treble our technical education programs. If this should take place suddenly, and American industry should have available two or three times as many engineering graduates, it would create havoc and demoralize the profession. In the solution of this problem, as in others created by the sputniks, we have to start farther back in our free-enterprise system. We undoubtedly need a more adequate supply of technically trained people, but we are *not* out of balance by a factor of three. The Soviets started from almost nothing and have a great deal of catching up to do. And, before we *train* three times as many technical people, we must give some thought to how we would use three times as many technical people.

"Reliable figures from the National Science Foundation show that the United States is spending about five billion dollars per year on "Research and Development." These figures are misleading because we have lumped together "research" *and* "development." It is certain from other available information that the basic-research portion of this total is extremely small.

"In any comprehensive program based on technology, be it industrial or government-sponsored, an effective *balance* should be sought between the basic research, the applied research, and the final production activity. There is a strong and growing feeling in civilian and government scientific circles that we are dangerously deficient and hence out of balance in the area of basic research. The Hoover Commission report of 1955 emphasized this. Numerous documents issued by high-level advisory committees of the Department of Defense have raised similar warning flags.

"To put our satellite in an orbit in all haste does not require that we do any basic research, it is true; this can be accomplished with existing scientific and technical information. However, far more important than competing with sputniks already overhead is to learn the lesson taught by all five sputniks. **The lesson is that we must mend our scientific and technological fences, all the way from the school classroom to the missile-launching pad, and we must do this so effectively that sputnik X, carrying an atomic warhead, will never be launched."** **end**

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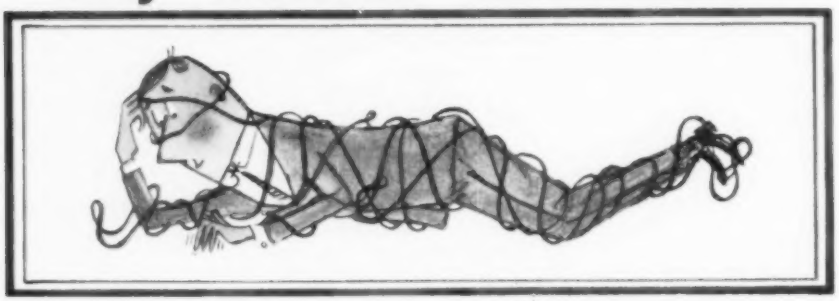

If your research and development program is lagging, it may not be just because "research takes time." Look for the hamstringing red tape, procedures and controls that would tax the patience of a saint.

JAMES W. REID

General Electric Co.

In the hysteria following launching of the Russian sputnicks, one thing became clear. Our research program was in need of a long-overdue assessment. Politicians screamed and accusing fingers pointed at everyone from the President down to the non-science high school senior. The National Science Council suggested state and federal governments grant more money to basic research. Secretary McElroy canceled 10% cutbacks in defense spending. Others urged a program which would prod more students into scientific fields.

But beneath all this long-range, high-level planning lies another problem—a self-induced headwind, buffeting both private and government research. It affects the researcher himself, desperately trying to do something in a hurry and repeatedly rebuffed by delaying regulations and red tape.

Hurry Up and Wait

The scientist has to idle away a week or so while his request for a piece of equipment is processed "through channels". . . . the creative engineer is delayed weeks, or months, while his design is given full "detail drawing" treatment in the drafting department . . . the development engineer has to twiddle his thumbs impatiently while three or more bids are obtained and evaluated.

These men, anxious to see the fruits of their efforts, must certainly have surplus enthusiasm—to wait out annoying delays, and still see their project through to a quick and successful conclusion.

The government cannot be held responsible for all these maddening tie-ups. It is true that government work imposes its own peculiar brand of restriction, but private industry is often as guilty. The trouble stems from management's failure to recognize distinct differences between a production and a research operation.

Research is Different

Many research departments are small or are set up to tackle specific problems. In these cases, or where economics do not allow an entirely autonomous research organization and the research department is simply tacked on to the existing system—beware! The ground rules, procedures and channels successful in production are not applicable to research. In research, the question is not "How can it be done effectively with the least expenditure of time and money?" but "Can it be done?" Research is a one-of-a-kind operation. Procedures designed to save costs on large-scale production actually increase costs when applied to research.

Supporting services—machine shop, purchasing, drafting, maintenance and the like—are a chief source of friction and delay when standard procedures are used. For example, of what value to the scientist is a full set of detail and assembly drawings of an apparatus when it will only be used to help him choose between paths A or B? A technician or machinist, working directly with the scientist, can often make needed equipment from a shop sketch in the same time it takes to fill out all the necessary forms and wade through the usual company channels.

Existing methods of doing business cannot be set aside, however, just to expedite research. The best solution is to place needed supporting services directly under research. This way, innumerable carbon-copies and records as well as administrative and clerical work can be eliminated, and proper emphasis placed on test

results and records at a substantial reduction in overall costs and the elimination of many built-in delays.

The Language Barrier

Research and production people may use the same words—but they speak entirely different languages. When a development engineer asks for a "shop drawing," he expects a small assembly drawing with notes about fits, materials and finishes. Instead he gets a full set of drawings, with tooling indicated and toleranced for interchangeability. When a scientist says "clean, dry air" he does not mean substantially clean and dry filtered shop air. He probably needs air from a special compressor, or bottled air. A production man might ask that something be "right on the button" and mean ±0.001. But a research worker may mean "within a wavelength of light."

Delays, and More Delays

A companion problem arises from the requirement that research adhere to the company's firmly established standards for purchased material and hardware. When readily available commercial material or parts were ordered through production purchasing, researchers of one company found that the orders were being changed to comply with government standards. This required alterations in design, and in many cases the corresponding government standard parts were not readily available and weeks of delay resulted. Separate purchasing departments solved this problem and saved both time and money.

Some accounting and control systems have costs and time delays built-in. Engineers are required to account fully for cost of each piece of equipment and buy them only in certain specified ways. For example, there are rules requiring: that more than one bid be obtained for any item costing over a specified amount (limits range from $100-$1000), that capital equipment or tooling charges be processed through several departments or managers, and that production orders in certain categories go through production control, stock control, quality control, planning, inspection, expediting, etc., before placing the order. Imposition of these systems may contribute something to economy and control but if a competitor gets to the Patent Office a day or two ahead of you, all the money invested in the project may be lost.

A more flexible plan is the answer. Research engineers can be allotted a certain sum or a definite time limit to complete the project. Held strictly accountable for expenditures and progress, they would still have the privilege of spending the money in the way they consider best for the project as a whole.

Call for Help

An expedient sometimes applied during periods of peak demand is farming out projects to outside firms. Often these firms are better prepared to do specialized work because of extensive facilities and long experience in a particular field. For example, test equipment too large for the research group to handle can be designed and manufactured by an outside organization. An engineer from the research group is assigned as liaison engineer. The contractor is familiar with the field and the liaison man knows company needs and practice.

This system, too, may become the victim of delaying procedural bottlenecks. For example, under a government contract, the engineer may find there aren't enough competent firms to make the customary three bids, or that the project is classified and the contracting organization is not cleared.

Research Means Freedom

Research in America can be accelerated if those responsible for its support fully recognize the fact that research implies flexibility—freedom to adjust to conditions that sometimes change overnight. Certainly some managerial control has to be exercised to assure that objectives are reached. But to delay simply because it is at variance with the standard procedures is more detrimental than helpful. Understanding the requirements of research will often pay off better than increasing the budget and establishing another hierarchy to make sure it is spent correctly. end

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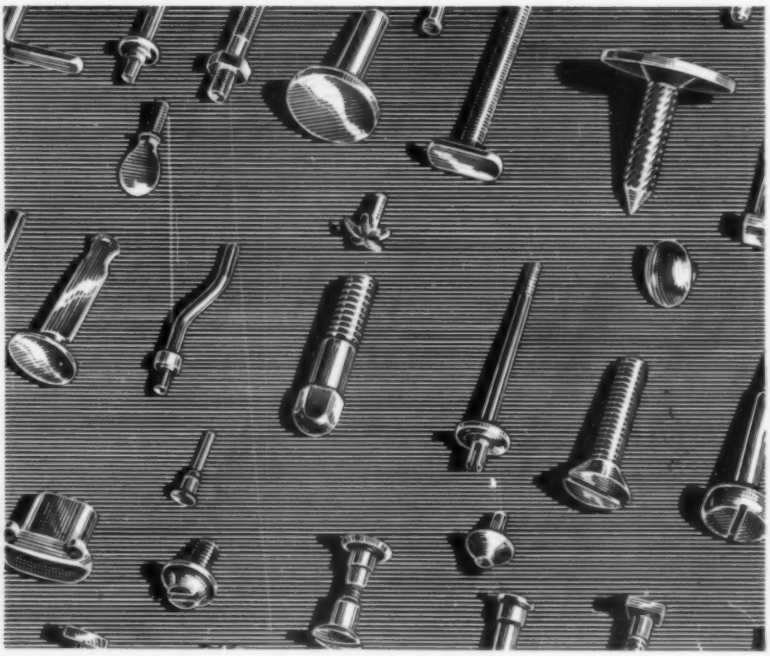

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So before you order wire again, get in touch with Chase. Tell us just what you do with wire ... what properties you look for ... describe any problems you may be having. Send us samples or drawings of your product. By studying your individual requirements, trained Chase technicians can help you gain greater efficiency and economy in production.

Contact the Chase Wire Service Man through the warehouse or office nearest you!

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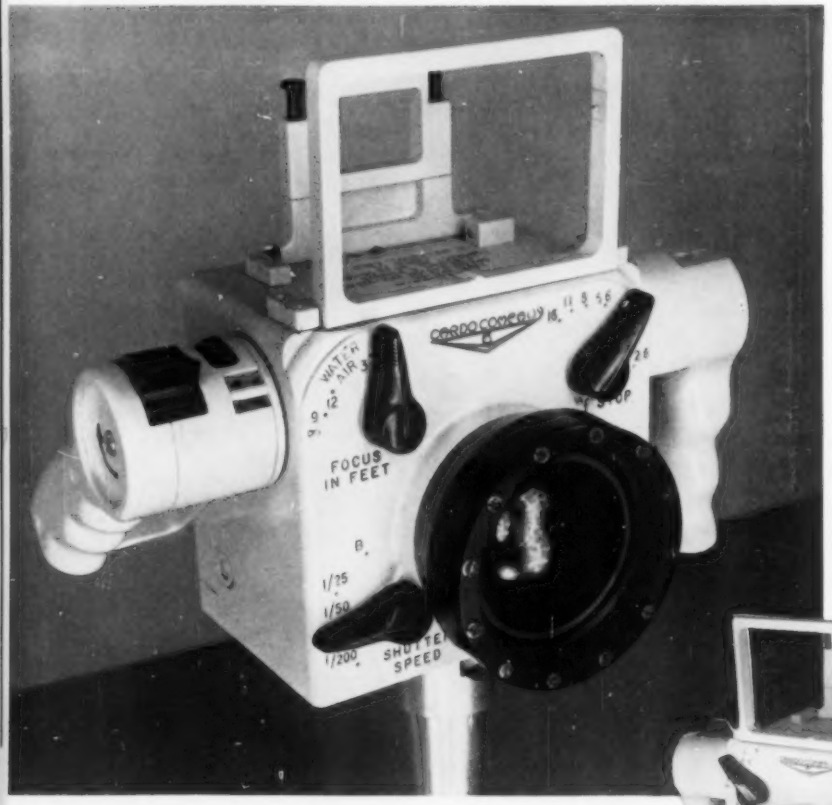
The Nation's Headquarters for Brass, Copper and Stainless Steel

Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York (Maspeth, L.I.) Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

TRENDS in appearance



Plastic-cased 35-mm camera answers Navy requirements for underwater combat photography. Focus, "f"-stop and shutter-speed settings are controlled by oversize levers with click detents; camera can be operated in dark by memorizing sequence of settings. Pressing large knurled button at top of right hand grip trips shutter; rotating this grip 90° advances film and cocks shutter. Viewfinder folds flat when not in use; parallax correction is provided by raising rear sight. Rotating cams lock back plate, silicone "O" rings prevent leakage. An air valve pressurizes camera before submersion. Manufactured by Cardo Camera Corp.

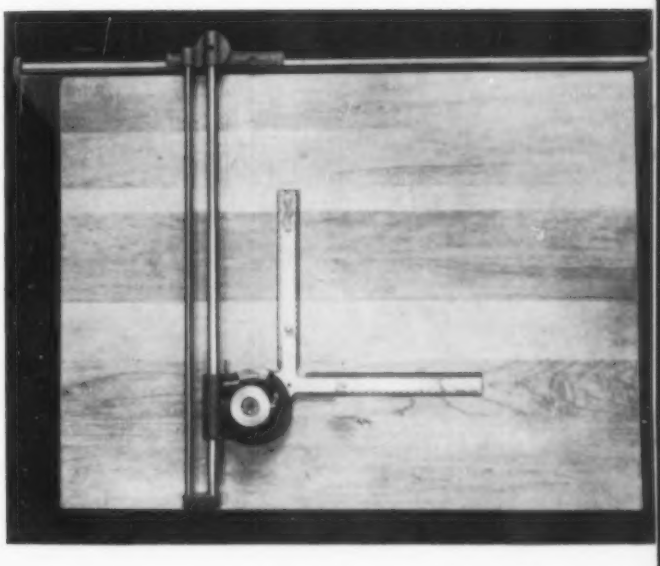
Reliable underwater flash is provided by a capacitor unit that eliminates shorting problem.

Television set by Sylvania appears to be flat against wall, yet as inset shows, cabinet top slides back for access to controls. Drawing illustrates how stand assures required distance from wall. Shorter (110°) picture tube projects 4 in. in front of cabinet, permitting front mounting of three speakers. Light-colored mask provides soft illumination around picture.

design...

All-transistor portable radio sections short-wave band into seven ranges, and provides AM broadcasts on an eighth. Dial distance between stations is stretched by separate band-spreads mounted on a cylinder that rotates. Three-foot outdoor antenna telescopes from handle; magnetic type is concealed but has cable permitting mounting on window. Charts and world time dial in front cover indicate where-and-when of best reception. Designed by Mel Boldt Associates, 919 N. Michigan Ave., Chicago, for Zenith.

Accuracy, simplicity and durability are stressed in this drafting machine by Glideline. Lightweight head provides 15° indexing through 360°; vernier gives intermediate settings to 5 min. Controls are designed for one-hand operation; fingertip pressure locks or releases setting or position easily. Stainless steel and aluminum construction combine durability with attractiveness.



Designing with BAKELITE Plastics

- ***Plastic converts the kitchen sink***
- ***Savings with corrosion-resistant exhaust ducts***
- ***Giant tools at small prices***

New materials create new design ideas . . . tougher coatings, parts made faster, built-in chemical resistance, or weight reduced without loss of strength . . .

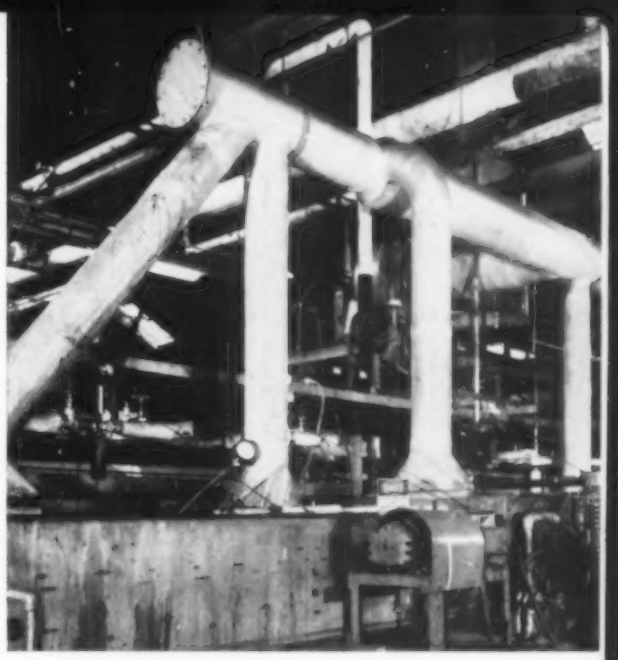
Perhaps you have an idea that's been waiting for a material to make it work.

These are reasons for examining the possibilities in plastics, the newest, liveliest category of basic materials. Plastics make news in design almost daily, because they do so much so well. Your best source of plastics and information about them is Bakelite Company. Here, you can choose from styrenes, polyethylenes, vinyls, phenolics, polyesters, epoxies, silicones and impact styrenes—the largest variety in the plastics field. And in addition, you can draw on Bakelite Company experience and technical assistance for aid in applying these materials to your design problems.

1 Vacuum-formed from impact styrene—two sinks for one

This design idea is the "Dual-Sink-Tray" insert for kitchen sinks that gives the housewife a double sink in an instant. The inventor makes it of BAKELITE Brand Impact Styrene TMD-2155, extruded by Campco, because this material has all the performance advantages he requires—in addition to a high Izod impact strength (3.6 ft. lb./in. of notch, ¼ in. thick), it offers a choice of colors, resistance to household cleaners and light weight. Its resilience prevents dishes from chipping or cracking.

This product is fabricated by a simple, economical, vacuum-forming process that affords deep draws and intricate design on a mass production basis. If you are interested in BAKELITE High-Impact Styrene and the vacuum-forming operation, write Dept. ZA-145.



2 Exit corrosive atmospheres . . . through corrosion-resistant plastic ducts

Laminations of BAKELITE Brand Resins for reinforced plastics and glass fibers are extensively used for large-sized structures. They are light in weight, strong, and resistant to attack by many chemicals and corrosive fumes. Since they need no protective coating, their maintenance is low. The example shown here is part of an exhaust system in a plant for pickling brass sheets. Air laden with sulphuric acid fumes passes through hoods and ducts to a scrubber that removes the fumes and expels them through a stack—all elements in the system being reinforced plastic made of these resins and glass fiber. The scrubber, weighing 500 lbs., would weigh about 2000 lbs. if made of metal, an important factor in reducing roof stress. For more information, write Dept. **ZB-145.**

3 Large-scale tools made with long-lived, dimensionally stable epoxy

Jigs, checking fixtures, and similar tools, large and small, have many advantages when made from glass cloth and BAKELITE Brand Epoxy Resins. The tools shown here have already been in service for three years, forming reinforced plastic swimming pool sections. They are among the world's largest plastic tools. In another material, the cost of tools this size, with comparable durability, accuracy, and dimensional stability, would be prohibitive.

In fabrication, epoxy resins are handled as liquids, so that they can be poured into place after being mixed with their liquid hardener. They cure overnight with almost no alteration in dimensions, and after curing, can be machined or patched if design changes are called for. Finished tools are extremely hard, and resistant to chipping and cracking. Another interesting application for this epoxy resin-glass cloth construction is its use for patching dented automobile fenders, since the epoxy has excellent adhesion to metal. For more information, write Dept. **ZC-145.**

There's more to design with in **BAKELITE** BRAND **PLASTICS**

POLYETHYLENES • SILICONES • POLYESTERS • EPOXIES
PHENOLICS • IMPACT STYRENES • STYRENES • VINYLS

UNION CARBIDE

BAKELITE COMPANY, *Division of Union Carbide Corporation,* 30 East 42nd Street, New York 17, N. Y.

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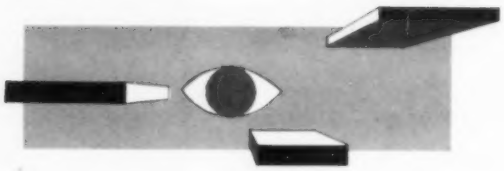

POINTS

THE QUESTION: **"Are Patents Any Good?"**

EDWIN J. ASHTON
Manager, Patent Div., Research Dept.
Caterpillar Tractor Co.
Peoria, Ill.

"Some are and some are not. . . .

Close to 1,000 US patents issue weekly, and a good portion of these will never find their way to a commercial market. Many ingenious patents, however, do issue which serve to promote the progress of science and the useful arts.

"I am sure that it is not fully appreciated how large a part patents have taken and how much they should be credited for the tremendous scientific and engineering advancements made during the past 100 years. The very fact that a patent grants to its owner a 17-year monoply is one of the principal reasons why the engineer and the scientist will concentrate his ability to design around a questionable patent. In doing so, he makes his own contributions which quite often are of a patentable nature.

"Patents, have played, and will continue to play, a big part in motivating the engineer to contribute to the advancement of our scientific world. It is for this reason that I would say, "Patents in general are good."

"There are a number of valid objections...

to the present patent system: delays, the dangers of disclosing information of value to competitors, the high cost of prosecuting infringements, expense, and even the occasional issuance of conflicting patents that have precipitated court battles. These difficulties are inherent results of an attempt to apply laws based on static concepts in an age of dynamic progress.

"Patents were designed to safeguard the individual inventor, so that he might profit by his talent and continue to exercise it to the advantage of society. Today, a patent per se does not do this. A man must have the financial backing to defend his patent, and the patent must be granted before it can be defended. Slow action on the part of the Patent Office tends to lead to miscarriage of justice by delay. Too many trivial patents are applied for, processed and granted. These increase costs and delays while adding little or nothing of significant value.

"Electronic patents particularly illustrate the faults of applying a static concept to a dynamic science. You can only patent a unique circuit, which may represent a new philosophy or line of thought in solving a problem. Any competent electronic engineer can examine a patent of this sort and come up with alternate means of accomplishing the same result. The exceptions to this rule are in the field of basic patents on such devices as transistors, crystal transducers and—the classic example—strain gages".

R. T. SILBERMAN
Vice-president for Sales
Cohu Electronics Co.
San Diego, Calif.

S OF VIEW

"They can be no better . . .

than the inventions upon which they are founded. If there is no invention or if there is little inventiveness or commercial worth contained in it, then the patent will have very little or no value. If the patent discloses a real invention of commercial worth, it has been of real service to the patent owner and the public alike. It is good for the patent owner as a reward for his efforts and capital outlays, and good for the public because of the contribution it makes to human progress.

"Without the hope of financial gain from the issuance of patents covering their inventions, most inventors and small companies simply couldn't afford to engage in inventive and developmental work. Without the products and processes resulting from such work our nation would stagnate and retrogress."

J. KING HARNESS
Chief Patent Counsel
Chrysler Corp.

DR. S. M. CADWELL
Director of Research and Development
U. S. Rubber Co.

"Patents are of real value . . .

in our business. They often enable us to take the lead or maintain our competitive position in industry. For example, patents on creamed rubber latex, antiozidents, vulcanization accelerators, battery separators, Asbeston, and Lastex, have played an important role in the growth of the United States Rubber Co.

"Exchange of patent licenses with other companies has also proven to be a profitable way to maintain and advance our business. We believe that one of the important advantages of patents is that they provide an incentive for early publication of current research accomplishments. This is of enormous importance to the rapid advancement of technology in the US."

"The radio and television industry . . .

is among the most competitive in the country, and research and advanced developments are of particular importance under such conditions. Public acceptance of our products stems in large measure from the fact that Zenith has consistently pioneered important innovations and new features in the home entertainment field. Without the patent system, through which such innovations can be protected against unauthorized imitation, the incentive to engage in large-scale research and development activities would be greatly reduced, and the public enjoyment of such advances would be delayed.

"Our organization consistently strives to obtain patent protection on our important inventions. We have found that this policy has been of material benefit, not only in returning royalty payments on Zenith developments licensed to others in the industry but also, and of even greater importance, in enabling us to maintain exclusive features in our products and thus to realize the maximum advantage from our research and development program."

G. E. GUSTAFSON
Vice-pres., Engineering
Zenith Radio Corp.

compact . . . power-packed

New General Electric

REDUCE YOUR

IMMEDIATE SHIPMENT of popular Tri-Clad '55' motor ratings—through 125-hp—is provided from factory, district warehouses, and distributor stocks.
TRI-CLAD
MOTOR
GENERAL ELECTRIC

TRI 55 CLAD motors can help you . . .

REG U.S. PAT OFF.

DELIVERY CYCLE

NOW AVAILABLE THROUGH 125-HP

CONVENIENT WAREHOUSE STOCKS provide immediate shipment of any popular G-E Tri-Clad '55' motor rating up through 125-hp. Nationwide stocks are maintained by distributors as well as 34 G-E district warehouses.

HIGH-SPEED PRODUCTION of all types of motors is provided by new automated manufacturing facilities. With these facilities, special-purpose motors are produced by General Electric almost as fast as standards.

G-E PRE-ENGINEERING SERVICE provides special motor designs to meet your immediate or future needs. Where conditions warrant, such motor designs could be stocked at nearby G-E warehouses to provide fast delivery.

immediate shipment . . . popular NEMA ratings

How many additional sales could your company have made this year if you could have delivered your product faster?

In today's highly competitive market, often just a few days can make the difference between a lost sale, and an important order for your factory.

NOW, TO HELP YOU REDUCE THE DELIVERY CYCLE OF YOUR PRODUCT, General Electric offers immediate shipment of popular Tri-Clad '55' motor ratings—up through 125-hp—from nearby warehouse stocks. Or, if you use a motor that is not standard, G.E. can give you faster shipment from the world's most modern motor manufacturing plant.

IF MOTOR DELIVERY TIME IS A FACTOR in your production scheduling, you can now reduce your delivery cycles, make shipment promises with more assurance, and give improved customer service.

FOR MORE INFORMATION on the complete Tri-Clad '55' motor line—now available through 125-hp, contact your nearby G-E Apparatus Sales Office or Authorized Distributor.

Section B891-10
GENERAL ELECTRIC COMPANY
Schenectady 5, New York

Please send me the following publications:

☐ **FREE BULLETIN (GEA-6602)** describes advanced features of new Tri-Clad '55' motors through 125-hp.

☐ **FREE SLIDE RULE (GEN-148)** to determine weight and space-saving benefits of new Tri-Clad '55' motors.

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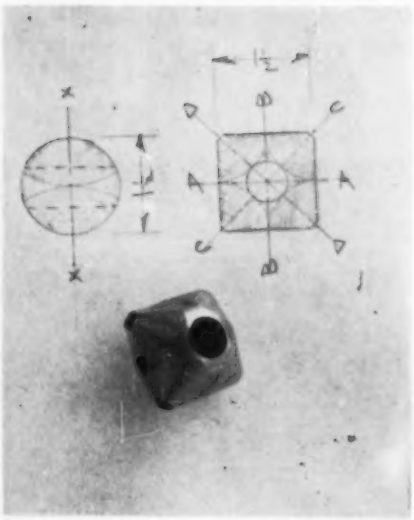
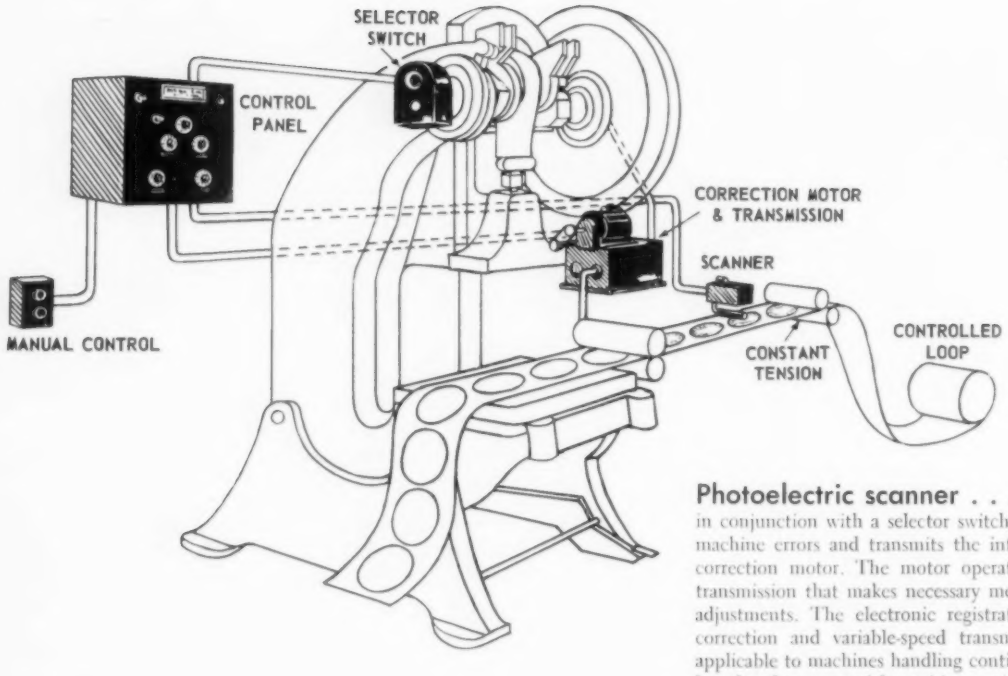
SIGNIFICANT PARTS



Sphere with conical corners drives . . .

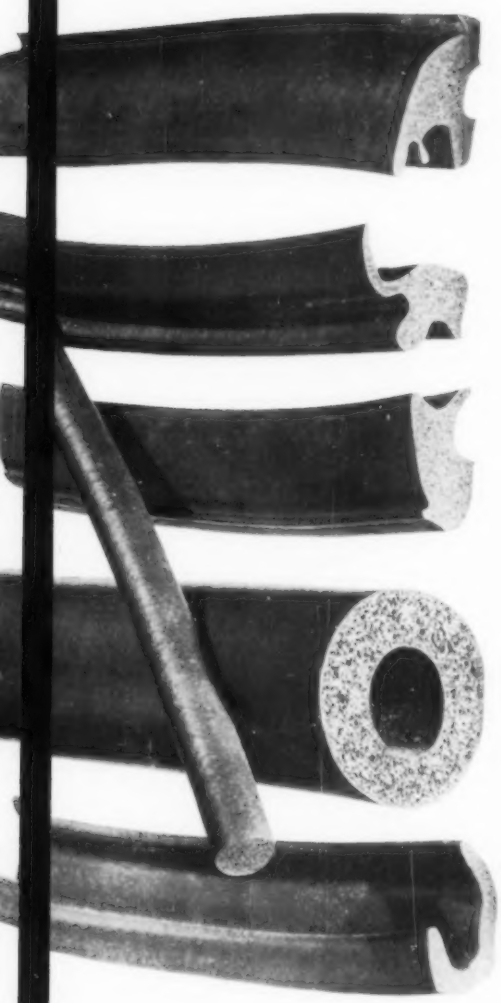
or is driven in square housing of universal joint that mounts on either square or round shaft. Male member can be left free to slide in housing to give end float; a fastened joint is also possible. Both may be equipped with flexible grease retainers. Either metals or plastics can be used for the sphere-and-cone-shaped shaft head. Max angle depends on depth at which head of joint is operated in housing. Price of sample ⅝-in. joint assembly is $7; available from stock. **Kvalheim Machinery Co., 34 Park Ave., Petaluma, Calif.**



Photoelectric scanner . . .

in conjunction with a selector switch, detects machine errors and transmits the information to a correction motor. The motor operates a correction transmission that makes necessary mechanical adjustments. The electronic registration controls, and correction and variable-speed transmissions, are applicable to machines handling continuous lengths of raw material requiring control of slippage, stretch, shrinkage, tension. Transmissions are available in five sizes, having outputs of 1 to 50 hp and designed for use with correction motors of ¼ hp. Average installations range from $1600 to $3500 (electronic unit about $1100 of this); about 60 days delivery. **Machine O'Matic, Inc., 2045 N. Hoyne Ave., Dept. 43, Chicago 47.**

MATERIALS · EQUIPMENT



Extruded closed-cell sponge . . .

can be made from butyl or PVC-nitrile combinations in densities ranging from 8 to 14 lb per cu ft. Tubing, rod and intricate shapes are all possible, with max dimension as small as $\frac{1}{8}$ in., as large as 2 in. Closed cellular structure provides continuous, sealed skin on all exterior surfaces. This material is said to be competitively priced and is in full production. **Kem-Blo Dept., US Rubber Co., 361 Church St., Naugatuck, Conn.**

Silica-reinforced plastic sheeting . . .

in $\frac{1}{4}$-in. thickness can resist 4600-F flame unscathed for 42 sec, burn-through for 142 sec. Prospects for short-interval performance for ultrahigh temperatures (possibly to 10,000 F) are favorable. The high-temperature insulation is practically pure silica in fiber form, laminated with a phenolic high-temperature resin. The sheeting can be made to any shape specified. Its weight is 1/15th that of stainless steel. The material can be machined using techniques similar to those used for fiber glass laminates. Pre-impregnated fabrics and fabricated parts are available, as well as basic fabrics and other fibrous silica materials for customer impregnating. Pre-impregnated cloth can be furnished in vacuum-bagging and press-molding grades and also as chopped fabrics on special order. Nominal fabric width is 32 in. Available from stock. **H. I. Thompson Fiber Glass Co., 1733 Cordova St., Los Angeles 7.**

Fluorinated silicone rubber O-rings . . .

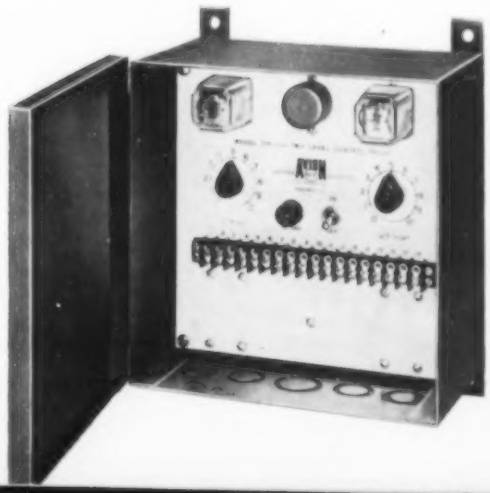
and seals retain resilience with a variety of hard-to-seal liquids, gases and mixtures from −80 F to 400 F. This rubber has 70 SDH rating; previous material had 50 SDH. Standard sizes MS-29513-6 through MS-29513-460 are available for 2-wk delivery. Prices range from $57.55 for 100 to $45 each. **Stillman Rubber Co., 5811 Marilyn Ave., Culver City, Calif.**

Miniature rotary transducer . . .

uses inductive sensing method and permits instrument null position to be shifted electrically, at will. Rotor shaft is ball-bearing mounted for min torque. Rotor makes no contact with sensing housing. Transducer can be used with standard measurement and control equipment. Size is 1¼ in. dia; weight is 3 oz. Available from stock to 30 days delivery. Models range from $200 to $350. **Crescent Engineering & Research Co., 5440 N. Peck Rd., El Monte, Calif.**

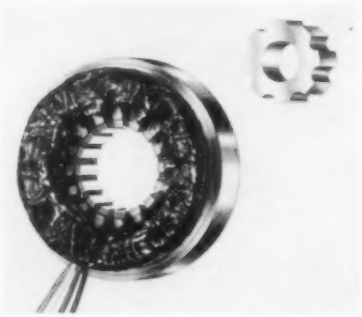
Two-level relay . . .

was designed to reject over and underweight units. Signal will cause opening or closing of one circuit or opening of one and closing of a second. Transistor-equipped relay has plug-in design; its center and spread of acceptance range may be adjusted. Suitable for process control and sorting. Price, about $600; delivery, 1 mo. **Avion Div., ACF Industries, Inc., 11 Park Pl., Paramus, N. J.**



Adhesive bonds vulcanized rubber parts . . .

to each other and to various metals. Creates a strong bond with rubber in 5 min at 240 to 270 F; adhesion to metal requires a cure of about 4 hr at 480 F under firm contact pressure. Material is translucent, nontoxic, contains no solvent and may be applied with knife or spatula. No special surface preparation beyond normal cleaning is necessary. Cured films develop strengths of about 25-lb pull per in. of width and retain mechanical strength and full resilience at temperatures from —70 to 500 F. Currently available in pilot-plant quantities at a price comparable to that of silicone rubbers. **Dow Corning Corp., Midland, Mich.**



Microsyn signal generators . . .

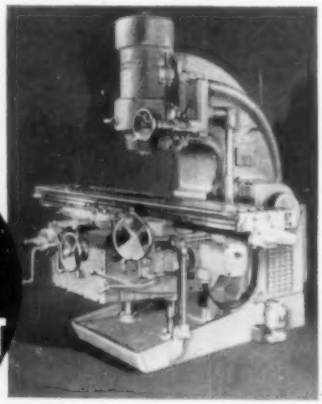
are temperature-compensated and produce a voltage proportional to angular displacement. Functionally, the signal generator is a circular differential transformer with a balanced bridge arrangement that compensates for errors otherwise introduced by electrical and mechanical dissymmetry. Different models of signal generators are available with ½% linearity and allowable angular rotation to ±20°, and sensitivities to 8 v per degree with a signal-to-noise ratio better than 0.01°. Units are of pancake design to ease mounting in a variety of applications. Physical size is 1⅛ x 0.4 in. long. Nominally supplied in 26 v input and a frequency range of 400 to 5000 cps. **Luther Mfg. Co., 7312 Varna Ave., N. Hollywood, Calif.**

Micro-miniature relay . . .

has a permanent magnet to remain operative under shocks of 100 g and vibrations of 30 G to 2000 cps with no contact openings. Linear accelerations of 400 g do not open the contacts. Measures 0.359 x 0.875 x 0.795 in. deep. Weighs 17.5 gm. Min contact pressure is 13 gm. Operates on approximately 1 w. The DPDT relay is capable of switching 2 amp at 30 v dc or 1 amp at 115 v ac resistive. It has an ambient temperature range of —85 to 257 F. Plug-in, bracket or stud mountings are available. **Potter & Brumfield, Inc., Princeton, Ind.**

Ruthman GUSHER COOLANT PUMPS

FIT EVERY REQUIREMENT



Illustrated is a Kearney & Trecker TF Knee Type Milling Machine equipped with a Gusher Coolant Pump.

There's a Gusher Coolant Pump to fit every requirement. You can choose from immersed, pipe connected, flange mounted external or internal discharge type Gusher Coolant Pumps in motor capacities from 1/30 to 7½ H.P. Also available are tank units and shaft, pulley driven and detachable bracketed standard motor driven pump. Whatever the type, Gusher Coolant Pumps give you long trouble-free life and exceptional performance.

Model 110208—short

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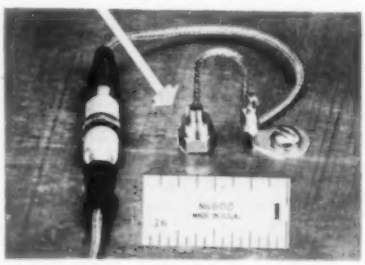
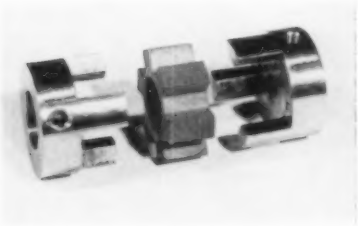


Subminiature accelerometers . . .

measure shock and vibration of small components and systems. They use barium titanate in compression as the sensing element, and attain a high natural frequency of 150 kc with sensitivity of 1 mv per g. Acceleration ranges from 1 to 40,000 g with a frequency coverage from 5 cps to 30 kc. Units are equipped with 6-ft lengths of subminiature, low-

noise cables designed for flexibility to minimize inaccuracy resulting from whipping effects and cable loading. **Columbia Research Lab., Woodlyn, Penna.**



Stainless and Teflon shaft coupling . . .

for fhp motors is designed for corrosive atmospheres. Coupling has a cushion body of glass-reinforced Teflon. Standard bore sizes from ¼ to ¾ in. are carried in stock. **Eco Engineering Co., 12 New York Ave., Newark 1, N. J.**

Material pressure regulator . . .

for 0 to 50 psi holds outlet pressure constant, without flutter, to pinpoint adjustment regardless of pressure in the main line. Unaffected by solvent action and abrasion, the regulator will handle any material with near normal pH. Design eliminates restricting passages and possibility of clogging. Removable wrench-type adjusting key allows permanent pressure setting. In-line regulator is equipped with 60-lb gage regulated so outlet pressure will be 50 psi max. **Alemite Div., Stewart Warner Corp., 1826 Diversey Pkwy., Chicago 14.**

. . . for sheer ruggedness and dependable power

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RELY on GI

Fractional H.P. Motors

1/40 H. P. to 1/1100 H. P.

In any industry, extra care in manufacturing means an extra margin of dependability. Nowhere else is this "extra" so important as in the manufacture of motors — for a product is only as good as the motor that powers it.

When you choose fractional hp. motors, remember GI's unmatched record for dependability. It's the ability to "take it" that has made GI first choice with the greatest names in American industry.

GI's complete manufacturing facilities mean economy, too — as well as on-time delivery. And if you have special fractional hp. problems — GI's design staff is at your disposal. You can Rely on GI!

Write for complete specifications and quantity price quotations today!

MODEL B
4-pole, 4-coil shaded pole AC Induction Type

MODEL A
2-pole, shaded pole AC Induction Type

MODEL C
2-pole, shaded pole AC Induction Type

MODEL F
2-pole, shaded pole AC Induction Type

MODEL O
2-pole Capacitor Reversible Type AC only (for 6, 12, or 24 volts)

MODEL E
4-pole, shaded pole AC Induction Type

MODEL D
4-pole, 4-coil shaded pole AC Induction Type

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HOW YOU CAN TAKE ANOTHER LOOK AT
BEVEL GEARS
Designers can now re-consider the use of bevel gears—due to the latest Gleason coniflex system of bevel gear proportions which we employ—to minimize gear mounting problems and for less trouble after assembly. Costs are less by this method, better finishes and smoother gear operations are a result, and because bevel gears are so efficient, they can now be used more extensively than ever before.
We can make bevel gears up to 3" in diameter with up to 16 diametral pitch for such products as instruments, power tools, differentials, appliances, and fishing reels. Process bevel gears are precision engineered, deliveries are prompt.
Send blue prints or specs for prompt estimates to the specialists in the Fine Pitch Field.
PROCESS GEAR COMPANY
4602 W. Fullerton Ave. • Chicago 39, Ill.
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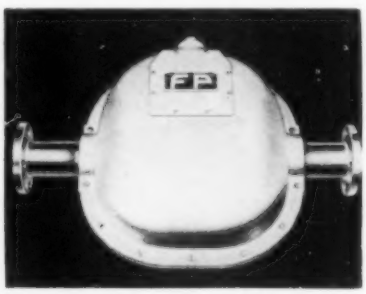
SIGNIFICANT PARTS MATERIALS EQUIPMENT . . .

Dc solenoid . . .

originally designed for nuclear reactors can be adapted to any specification where rigid operating conditions are encountered. Made of Type 304 stainless steel and high-permeability iron, specially nickel-plated 0.002 thick. Operates continuously submerged in both pure and contaminated water, 300 F at 30 v dc. Stroke is 0.062 in.; a force of 125 lb is produced at the beginning and a hold-in force of 180 lb at the end of the stroke. Unit is 2¼ in dia, 4.5 in. long. **G. W. Lisk Co., Inc., 2 South St., Clifton Springs, N. Y.**

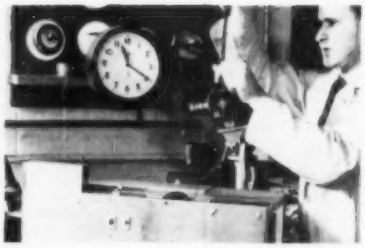


Magnetic flowmeter . . .

measures the flow rate of acids, slurries and other liquids without damaging itself. It can be adjusted manually to any desired flow rate at full scale, has unrestricted flow, and can measure flow in either direction. Readings are unaffected by velocity profile, density or viscosity, voltage change between 90 and 125 v and frequency changes between 55 and 65 cps. Special piping for long metering runs is not required. The 1-in. meter can be set to handle from 3 to 40 gpm at full scale; the ½-in. meter can be set to as low as 1 gpm. In ½, 1, 2, 3, 4, 6, and 8-in. sizes. **Fischer & Porter, 458 Jacksonville Rd., Hatboro, Penna.**

Rapid film processor . . .

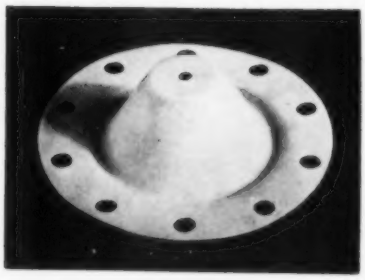
is portable and permits inspection of research and development film within minutes after exposure. The automatic self-feeding device can develop 16-mm film at up to 10 fpm and still attain commercial



quality. Size is about that of standard file drawer. Major elements in the processor are easily interchangeable film-transport plastic inserts containing high-speed developer, a rapid fixer, a hypo-eliminating agent and a static rinse. Drying is achieved by a high-velocity air jet on emulsion side of film. Stainless steel with an aluminum rear housing. Chemical tanks, which hold 18 oz of liquid each, are removable. Weight is 70 lb dry. The processor is independent of all utilities, except 110-v ac. **Fairchild Camera and Instrument Corp., Robbins Lane, Syosset, L. I., N. Y.**

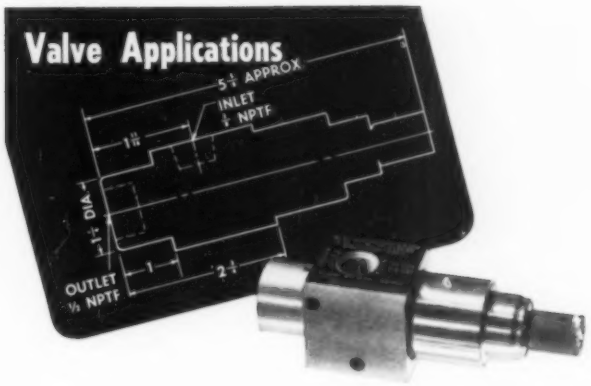
Electronic tachometer . . .

measures rotational speeds from 0.1 to 10,000 rpm. within 1%. A manual selector changes a specific full-scale range electronically. Radial lines scribed on a rotary disk interrupt a light beam in the transducer producing 360 pulses per rev. An electronic circuit detects the pulses and indicates them on a large meter. Unit operates from —30 to 160 F. Inertia and break-away torque are negligible. Transistor circuitry permits operation under severe vibration. **Southwestern Industrial Electronics Co., 2831 Post Oak Rd., Box 13058, Houston 19.**



Variable-area diaphragm . . .

converts fluctuating pressures into energy sources for stable control of fluid-handling valves. Its use eliminates pressure regulators in many cases. Piston seal is self-compensating and operates as a ratio-controller. Effective area changes in a predetermined way with stroke. In a valve motor it gives stable control over varying pressure changes; as loading pressure on the variable-area seal is increased, actuating action becomes less sensitive. **Bellofram Corp., Burlington, Mass.**



Here is a high flow, low pressure fuel valve which handles 560 pounds per hour of fuel flow at an inlet pressure of 30 psi. with a 1 psi. pressure drop. Another example of the versatile family of electro-mechanical devices developed and precision produced by Koontz-Wagner, this valve operates in a -65° to 250° F. ambient range at 17 to 30 volts DC. Special application valves, solenoids and switches designed, developed and produced by Koontz-Wagner may have the answer to your problem. Write now to:

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CASE HISTORIES FROM MT. VERNON FILES

RONSON produces the First Electric Shaver with 2 Separate Cutting Heads

Ronson calls their new "66" Shaver "the most revolutionary electric shaver ever designed"—and offers strong evidence to support this claim. For one thing, it is the first electric shaver with an *extra* cutting head, called "Super Trim", which does every trimming job, from sideburns to mustache.

When any manufacturer is out to break precedent, and still sell his product at a competitive price, he needs every bit of designing and production skill he can find—anywhere.

Ronson found these in generous abundance at Mt. Vernon. Three of the vital parts of the "66"—the head frame and the plate covering the "Super Trim" blades (zinc castings), and the motor chassis (an aluminum casting)—were designed to obtain the special advantages of die casting: thin wall sections of great strength and rigidity, negligible machining, smooth finish, high speed production, low cost.

Says Ronson: "These parts are highly vital to our electric shaver. The cutting mechanism depends on the head frame for its accuracy of mounting and rigidity while cutting. The chassis on which the motor is built is of course the heart of the shaver's power system, and a very accurate casting is necessary for the job."

These advantages, important to any manufacturer, stem directly from the way we are organized here at Mt. Vernon. We have both the facilities and the complete die casting service it takes to produce parts like these, in any quantity, at minimum cost. We have 200,000 square feet of the most modern equipment for making dies and for die casting aluminum and zinc. And Mt. Vernon service comprises completely coordinated designing, die-making, casting, and machining, all under one roof.

It will pay you well to bring your production specifications to us. We may show you, as we did Ronson, the way to important cost reductions and improved products.

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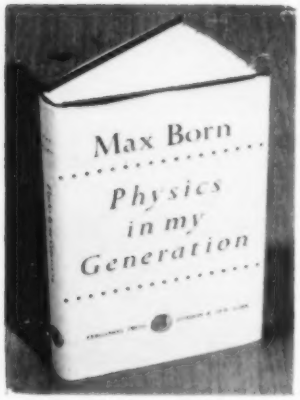

NEW LITERATURE

Physics in My Generation

MAX BORN. *Published by Pergamon Press and distributed by the McGraw-Hill Book Co., 330 W. 42nd Street, New York 36. 5½ x 9 in., 230 pp. $6.50.*

Professor Born is both a physicist and a scientific philosopher. His extensive training in the sciences—at Breslau, Heidelberg, Zurich, Gottinger, Cambridge—and his outstanding work in theoretical physics—he earned the 1954 Nobel Prize for his fundamental research in quantum mechanics—has given him an acute insight into the scientists' search for truth and their effect on mankind.

This selection of Prof. Born's popular addresses and articles illustrates how attitudes toward some fundamental concepts of science changed during the 30 years the writing's span. The book opens with the introduction to his "Einstein's Theory of Relativity" written in 1921; it is based on the views generally accepted at that time, that science produced an objective knowledge of the world (a world governed by deterministic laws), and expresses the author's conviction that the scientific method was superior to the more subjective approach of philosophy, poetry and religion. It also voices the hope that the unambiguous language of science was a step towards better understanding between men.

The book closes with the postscript to the author's book "The Restless Universe," published in 1951, which shows the complete change of attitude to these questions that has taken place in the intermediate years. The author says:

"In 1951 I believed in none of these things. The border between object and subject had been blurred, deterministic laws had been replaced by statistical ones, and although physicists understood one another well enough across all national frontiers they had contributed nothing to a better understanding of nations, but had helped in inventing and applying the most horrible weapons of destruction. . ."

Then he continues—

"The change of ideas was not arbitrary, but was forced on the physicists by their observations. The final criterion of truth is the agreement of a theory with experience, and it is only when all attempts to describe the facts in the frame of accepted ideas fail that new notions are formed, at first cautiously and reluctantly, and then, if they are experimentally confirmed, with increasing confidence."

Most of the articles are concerned with this development of scientific philosophy. Included are pieces on the physical aspects of quantum mechanics; the meaning of physical theories; philosophical aspects of modern physics; Einstein's statistical theories; physics and metaphysics; development and essence of the atomic age. There are also side reflections on social problems facing scientists. At all times, however, the author's concepts are thought-provoking, easily understood. NC.

Magnetohydrodynamics

Edited by Rolf K. M. Landshoff, published by Stanford University Press. 6¼ x 9¼ in., 115 pp. $4.

This is a highly technical discussion of a new field—the study of ionized gases and how they can be controlled by electrical and magnetic fields. This science promises to open up a new form of propulsion (see Sept. 25, p. 17; and Oct. 7, p. 13), and to contribute much to our knowledge of the fusion (thermonuclear) reactor. The book itself, based on a symposium attended by pioneers in the field, assumes more knowledge of the subject than the average reader is likely to have. But, as the first major publication in science that will be getting a great deal of attention, it's well worth noting.

Labor and Automation

Abstracted from "Labor and Automation," by Ted F. Silvey, National Headquarters Staff AFL-CIO, ISA Journal, Oct. 1957, 313 Sixth Ave., Pittsburgh 22.

Member of national AFL-CIO staff discusses modern instrumentation, defines data logging from a novel viewpoint, places automation in his own historic and economic frame, gives trade union thinking about unemployment, shorter hours, guaranteed annual wage and technical education.

Bibliographical Monthly on Electronic Computers

Published by Bureau of Technical Information, Iota Services, Ltd., 38 Farringdon St., London, E.C. 4, England. Mimeographed and stapled 8 x 13, Vol. CI, No. 1 is 29 pp. Subscription is about $18/yr (£6.6 s).

A specialized staff in England is presently scanning and abstracting international technical literature on computers and compiling this into a monthly bibliographical publication. The bulletin, published the first of each month will provide a complete record on everything published on computers, fully annotated. Books, articles, technical films, patents, meetings, reports, exhibitions and trade literature will be covered. In scope, it will deal generally with design, analog, digital units and converters. Detailed information, too, on computer applications. Vol. I contains all of this, followed by an author index.

A WIRING PROGRAM—Brochure, 20 pp, to evaluate individual wiring problems. Describes facilities and personnel available at the company to solve these problems. Illustrations of products and facilities. AMP, Inc., Harrisburg, Penna.

COMMUNICATION PROBLEMS—Two booklets, one 6 pp and the other 14 pp, have been adapted from talks on visual communication. "Option is Ours" analyzes weaknesses of words and presents argument for increased use of visuals. "Technical Presentation" is intended to assist engineers and other technical people in theories and techniques for presentation of technical material. It is a scholarly, documented outline. Illustrated with applicable material. Technifax Corp., 195 Appleton St., Holyoke, Mass.

SLIDE CHART—Calculates surface characteristics and indicates available processing techniques and recommended roughness. This handy slide rule is offered to readers who request on letterhead. Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich.

CIRCUIT CONTROLLING COUNTER—Bulletin 505, 8 pp. Construction and operation of multistage unit with automatic recycling. Switching patterns and schematics are shown. With photos of models, and dimensional drawings. Counter and Control Corp., 5225 W. Electric Ave., Milwaukee 19.

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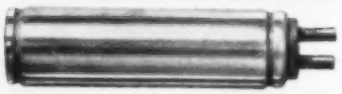

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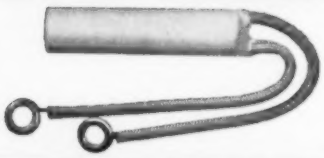

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Publisher's Postscript...

Don't blame the scientists

As one reads the newspapers today, it seems that all our trouble is blamed on the scientists–it's their fault that we haven't put a traveling advertisement in the sky. Russia did–where is ours?

Every well-informed businessman knows that it's not the scientist but the engineer who is responsible for the products we put on land, in the sea, and in the sky. The scientist is responsible for basic principles, for the fundamental theories underlying a given development, but until the engineer interprets fundamental scientific information in terms of a tangible product, we see little action.

The time lag between scientific development and engineering application is perhaps too great. Scientists and engineers seem to live in different worlds. Communication and liaison among them in the past has not been good, and that perhaps accounts for some of the recent criticism. But the situation is changing, especially in some of the large corporations that are investing important money in basic research, as well as in product research and development.

The irritating pressure, generated by Russia's widely publicized achievement in the sky, is having a most beneficial effect in bringing our scientists and development engineers closer together. They are going to be working closer under some sort of coordinated direction in the period ahead to make sure that we do not waste too much time in converting scientific knowledge into workable product designs.

Our attention under the present embarrassment should be focused on the design engineer, rather than the scientist. Remember the definition of engineering as "science with a sense of urgency," as suggsted by Dean Carson of Ohio State. Unless we can speed up the interpretation of basic research into product application and development, through practical design and product development engineering, we are going to continue to lag behind.

—A. H.

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74 for Your Information (personal)

You boil the timer too

Set the dial to the proper heat index, then put it in the pot, and it sets off a clamoring bell when soup's hot or baby's formula is ready. "Ding-Go" has a triangular bimetal strip between its tripod legs. The strip bends with rising temperature; trips the bell-release. With its dial of molded nylon, entire unit can stand boiling, yet remain comfortable to the touch. This thermal alerter can be bought for $3.85, postpaid, directly from its designer, Wells Extended Pin & Mfg. Co., Comptche, Calif.

Be your own weatherman—de luxe

"Professional" amateurs can now invade weather forecasting as they did photography. Latest catalog of one mail-order house lists a recording barograph ($100) and a wind-speed meter ($19.95) that would do credit to any pro. The former has a regular cylindrical chart recorder, and the latter gives velocities in both mph and Beaufort scale. A third device of this type is a neatly-styled combination that includes a remote-reading unit, complete with cable for connecting indoor indicator with the outdoor sensing devices, that sells for $169.

Maybe this trend toward souped-up units for the amateur is a sign of the times. The same company features a pogo stick with built-in score counter "to eliminate arguments" among small fry.

This one does work

Get a good idea—and someone appears with an even better one. Two months ago (Oct. 7), we mentioned a miniature slide rule attached to a tie clasp, perfect in every detail, but non-operating. Now, another company, Zinn Originals, 174 Fifth Ave., New York 10, comes up with one that does work. It's just 2 in. long, clips neatly to your tie when not in use. Sterling silver model costs $5; gold plate, $4.75.

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WHY DON'T THEY RESEARCH and DEVELOP...

. . . a quick windshield defroster for automobiles. It is irritating to be ready to go to work on a cold morning only to find frost, ice or snow coating the windshield and needing hard scraping. The system should clear the windshield in a minute, at most, and heat the windshield to prevent refrosting. There are two sources of heat in an automobile, electricity and engine exhaust. A conductive glass could probably be used on new cars. A system for temporarily deflecting the exhaust air over the windshield might be best for older models. —H. D. Ballard, *Wichita, Kan.*

. . . some practical solution to the busy-intersection problem. Heavy traffic, both pedestrian and automobile, piles up from all directions. Pedestrians can't all get across during one light change, automobiles can't make turns. Overhead pedestrian passageways have been suggested but they must provide easy crossing between any two corners. Further, people won't want to climb stairs and so Escalators will be needed. One further mechanization: set a large turntable over the center of the intersection and have it turn very slowly so that people are carried around to the desired moving stairway. Any other ideas?

. . . a more practical alarm clock than those presently available. For example, you should be able to set two separate alarm times at night so that the husband (waking at 7 a.m., say) doesn't have to reset for his wife (waking at 8). The alarm should ring at 7, be shut off with a lever or knob, and then ring again at 8. Also, how about an alarm clock that rings only once in 24 hours? It would be set once and automatically ring every morning. Also one would not be limited to 12 hr if a super-snooze was desired.

. . . and how about more extensive use of thermometers in home appliances? They are now built into ovens, but rarely in refrigerators and never in water faucets, shower heads, pots and pans, window air conditioners. You can buy individual thermometers and set them where you want them but the retail price is much above what a manufacturer would pay and a unit is always more convenient when built-in.

Have you a pet project but neither the time nor inclination to do the necessary R & D? Product Engineering will welcome (and pay $10 each for) similar ideas based on known scientific principles but lacking an inspired manufacturer

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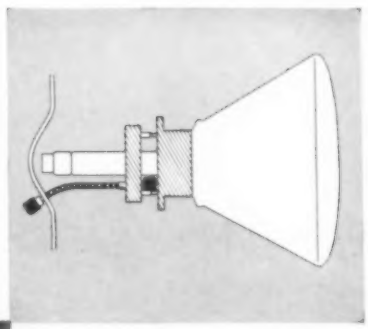

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